TRUSCON
STEEL JOIST
DATA BOOK

TRUSCON STEEL COMPANY
YOUNGSTOWN, OHIO, U.S.A.

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Truscon Steel Joist Data Book

Applications—Tables
Specifications—Details

TRUSCON STEEL CO.
TRUSCON
BUILDING PRODUCTS

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Truscon Steel Joist Construction

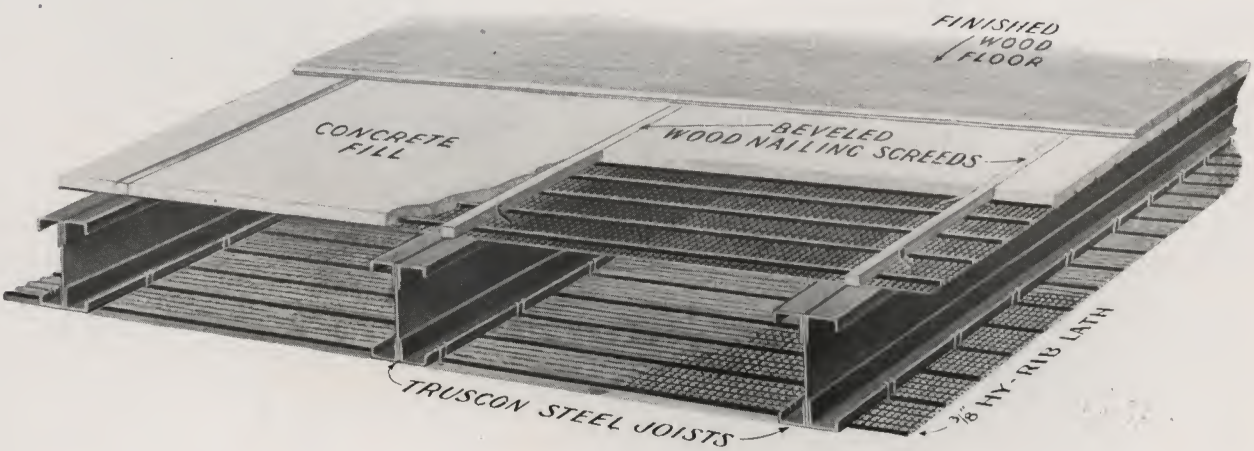
Simplicity Truscon Steel Joist Construction is fireproofness in its simplest terms. Merely place the Steel Joists, apply the metal lath and concrete above and attach the metal lath for plastered ceiling below. No centering or false work is required. Any number of floors of a building can be installed simultaneously. No special equipment or expensive plant is needed. A small working force installs the construction in quick time. It is really simpler to use than wood because all members are completely shop-fabricated, cut to length and fitted.

Light Weight Weighing 40% to 70% less than other fireproof floors, Truscon Steel Joist Construction is not only economical in itself but effects substantial savings in the supporting framework and foundations. This is particularly true in light occupancy buildings, where other fireproofing systems require half their strength to support their own weight. The light weight of steel joist construction is of utmost value in additional stories of old buildings, often permitting the addition of a floor more than originally contemplated.

Fireproofness Structural steel shapes, because of their process of production, have their fibres distorted in their manufacture. When heat is applied, around 700 degrees, the internal stress is released and the steel member becomes distorted and twisted in shape. The process of manufacture of Steel Joists causes no internal stress, with the result that ample strength is available up to temperatures around 1000 degrees to 1200 degrees, with no tendency to twist or distort. Repeated fire tests have proven that 7/8″ of cement ceiling plaster will protect Steel Joist Construction against temperatures of as high as 1700 degrees, such conditions developing less than 550 degrees around the joists. The fireproofness of Steel Joists has been developed not only in tests but in actual fires in comparison with other constructions.

Crackproofness Metal Lath thoroughly reinforces the plaster and prevents its cracking. Made entirely of steel, Truscon Steel Joist construction has no tendency to shrink, swell or warp, as occurs in wood construction. The saving in cost of redecoration and in expense for repairs is substantial.

Soundproofness Sound is vibration and is transmitted through bodies by molecular action. These vibrations will naturally be transmitted through one continuous material more readily than through a series of materials with different densities. In Steel Joist Construction sound must pass first through a layer of



Truscon Steel Joist Construction with Wood Floor Finish. 3/8″ Hy-Rib Lath for Floor and Ceiling.

Ideal for Light-Occupancy Buildings

concrete, second through steel joists or air space and third through a layer of plaster. All these materials vary widely in density with the result that Steel Joist Construction is exceptionally soundproof. The extreme rigidity of the construction prevents the vibration of the entire floor as a body. Its soundproofness is practically demonstrated by the unusually satisfactory results obtained in hundreds of hotels, hospitals, apartments, etc.

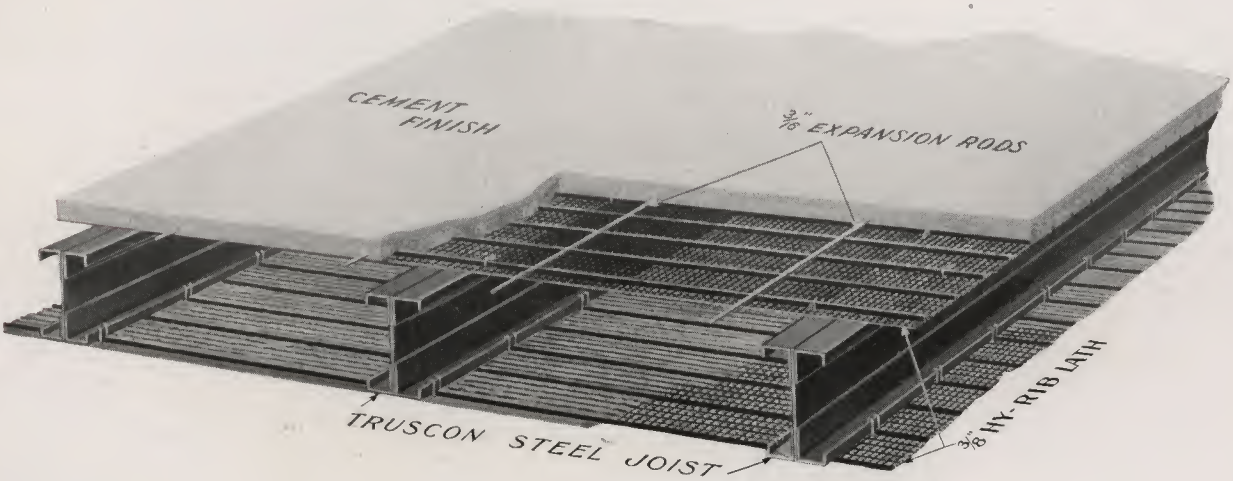
Quick Erection Installation of Steel Joists is very rapid, because they are shop-fabricated and entail the minimum amount of field labor. Being self-sustaining, a number of floors can be installed at one time.

Winter Building As the Steel Joists carry all the loads, the construction is installed as readily in winter as in summer. Unlike many other fireproof construction systems, it is not dependent upon the setting of cement, which is seriously retarded by cold weather.

Adaptability Steel Joists are used with equal facility in all kinds of light-occupancy buildings, regardless of their location. They are used in small buildings, at practically the same cost per square foot as in the large ones, having the same economy in the first floor of a residence or in a skyscraper hotel. Fireproof construction is thus made available in thousands of places where other systems of fireproof construction are not practical, because of their necessary expense for special equipment, extensive plant and large overhead. Truscon Steel Joist Construction not only eliminates these big items of cost, but provides fireproofness of proven worth.

Assured Strength The strength of Steel Joists is built into them at the factory. It is not dependent upon the mixing of various materials on the job. Comparatively little supervision is required in placing the joists, and thorough inspection is simple after their installation.

Economy The economy of Steel Joists occurs not only in the construction itself but in the savings that it effects throughout the building in the beams, columns, walls and foundations, and in the advantages it offers to other contractors working in the building. Its speedy erection saves the owner interest charges on his investment, and cuts down the overhead expense of the contractor making the installation. In the completed building, its durability and permanence save in insurance costs and upkeep expense. For light-occupancy buildings, large and small, it costs less than other fireproof constructions.



Truscon Steel Joist Construction with Cement Floor Finish. 3/8" Hy-Rib Lath for Floor and Ceiling.

Apartments

Ritz Apts., New York, N. Y.
Ritz Holding Co., Newark, N. J.,
Contractors and Architects

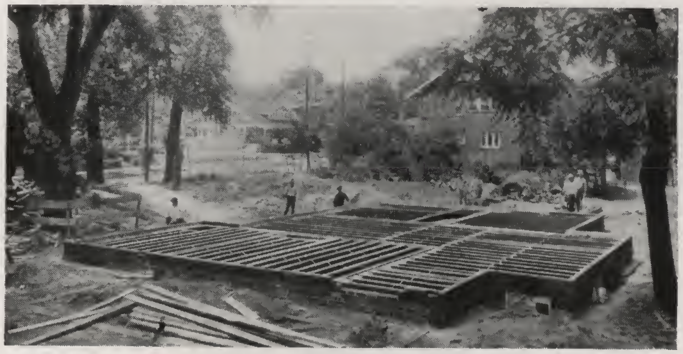
Alger Court Apartments, Bronxville, N. Y.
Bates & Howe, Architects
North Eastern Construction Co., Contractors

Westfield Apartments, Detroit, Mich.
Geo. W. Graves, Architect,
Ragowski Bros. & Wedda, Contractors

Wade Park Manor, Cleveland, Ohio
Geo. B. Post & Sons, Architects & Engineers
John Gill & Sons, Contractors

In this field, whether a small flat or large apartment hotel, Truscon Steel Joist Construction is supreme. Its advantages of fireproofness, crackproofness, low upkeep, increased rentals, soundproofness, etc., appeal to all owners who consider investment value.

First Floors Of Residences



Residence for
G. A. Caldwell,
Decatur, Ill.

Aschauer & Waggoner,
Architects,
Frank Weber, Cont.

Ninety per cent of residence fires originate in the basement. First floors of fireproof Steel Joists, protect homes from this menace and from plaster cracks, due to shrinkage and settlement.

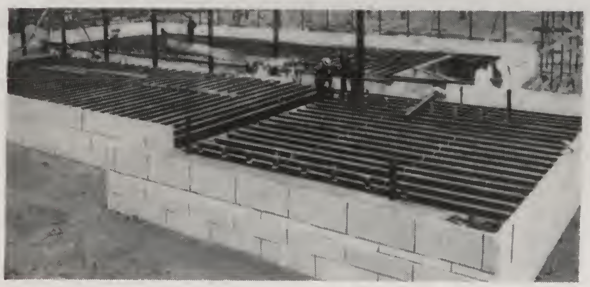
Schools

High School, Cuyahoga Falls, Ohio
Charles W. Bates, Architect
The Carmichael Company, General Contractors

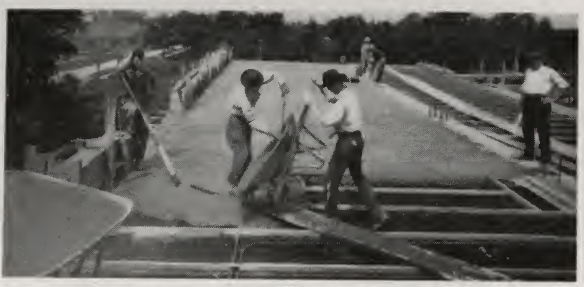
Practical Arts High School, Manchester, N. H.
C. R. Whitcher, Architect
I. F. Woodbury & Sons Co., Contractors

Leavittsburg School, Leavittsburg, Ohio
Heller Bros., General Contractors
Designed by Miller & Sons, Archts.

West Junior High School, Lansing, Michigan
J. N. Churchill, Architect,
H. G. Christman Co., Contractors



Girls High School, Malden, Mass.



Ferndale School, Detroit, Michigan

The horrible calamities that have occurred in school fires make it unnecessary to make an appeal for the fireproof construction of these buildings. Truscon Steel Joists offer a simple fireproofing which is as well adapted to a building in a sparsely settled locality as in a large city.

Public Buildings, Libraries, Etc.

City Hall,
Massillon,
Ohio

Erected 1907.
Inspected 1921
and found perfect.

In all municipal, state and federal buildings Steel Joist Construction can be used to advantage. Its many points of superiority are also important in remodeling old structures to make them fireproof.

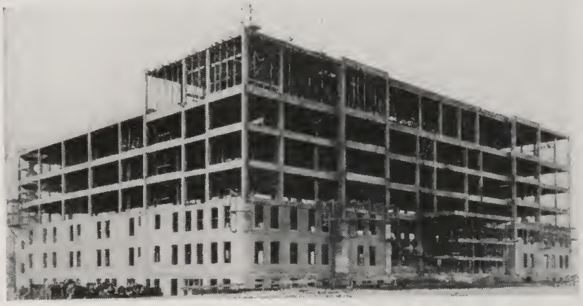
Hotels

Augebilt Hotel, Orlando, Florida
Murray S. King, Architect

Shelbourne Hotel, Atlantic City, N. J.
H. C. Balcon, Engr. Warren & Wetmore, Archts

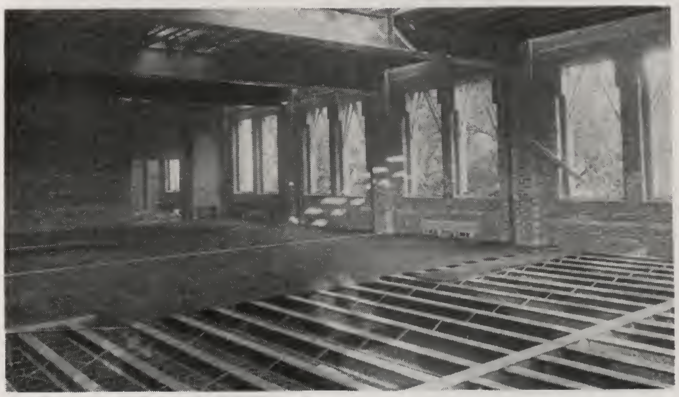
Fireproofness and soundproofness are essential to modern hotels. Truscon Steel Joist Construction provides them at economical cost. Speed and simplicity of erection are assured to any hotel, whether in the big city or the small town, no matter what the size of the building.

Hospitals and Sanitariums



Hospital, Sisters of Mary, St. Louis, Mo.
A. B. Groves, Architect, Brussel & Viterbo, Engineers

Methodist Episcopal Hospital, St. Joseph, Mo.
Eckel & Aldrich, Architects

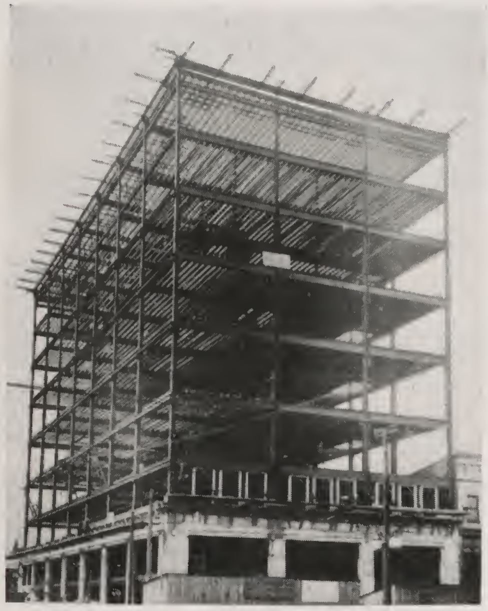


Nurses Home,
St. Vincent's Hospital,
Toledo, Ohio

Thomas F. Huber, Archt.
Henry J. Spieker Co.,
Contractors

Sanitation, which comes from the use of materials that cannot decay and offer no lodging places for mice or vermin, is a feature of Truscon Steel Joist Construction. Hospitals especially must be fireproof for protection of helpless patients and soundproof to assure quiet for their comfort.

Stores, Offices and Banks



Snyder-Hess Store, Massillon, Ohio
Wm. Robert Powell, Architect

Mayo Building
Tulsa, Oklahoma

Belden Brick Co.
Canton, O.

Additional Stories, Crowley Milner & Co.
Detroit, Mich. Albert Kahn, Archt.

Sullivan Building
Pittsburg, Penna.

The large department store or the small neighborhood store, the skyscraper or the small office building, the main or the branch bank, all find Truscon Steel Joist Construction equally economical. Its light weight makes it particularly advantageous for additional stories of old buildings.

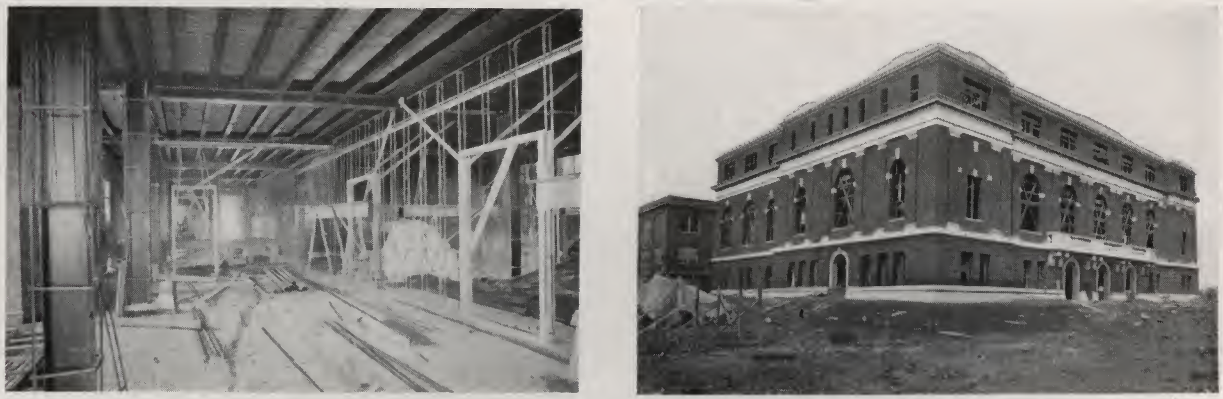
Clubs and Fraternal Buildings

Masonic Temple, Highland Park, Mich.
Geo. W. Graves, Architect

Club House, K. of C. Lodge, Kankakee, Ill.
Herman Gaul, Archt., Houde Const'n Co., Cont.

Such buildings should be durable, fireproof and inexpensive in upkeep. Truscon Steel Joists are especially economical in country clubs which are inaccessible to fire protection and building labor.

University Buildings



Home Economics Building, Howard University, Washington, D. C.
Hazel and Cassell, Architects *Consolidated Engineering Co., Contractors*

Steel joist construction has been used extensively by universities and colleges. Their buildings, carefully planned for varied uses, must essentially be fireproof and soundproof, and have long life.

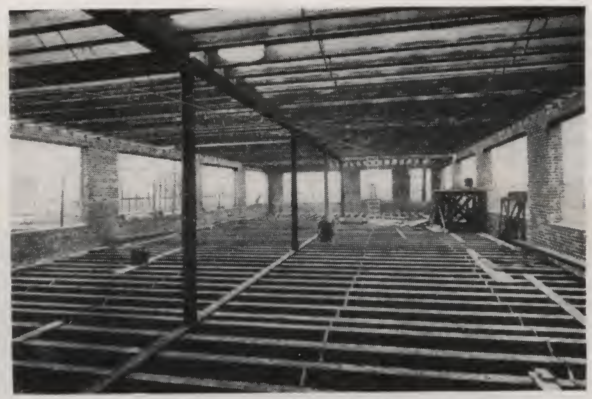
Theatres

Norva Theatre, *Norfolk, Va.*

Owing to its simplicity, Steel Joist Construction is ideally suited to the complicated framing required for auditoriums, balconies and roofs of theatres. Its fireproofness is an important advantage.

Buildings for Light Manufacturing

E. J. Woodison Factory, Detroit, Mich.
George W. Graves, Architect



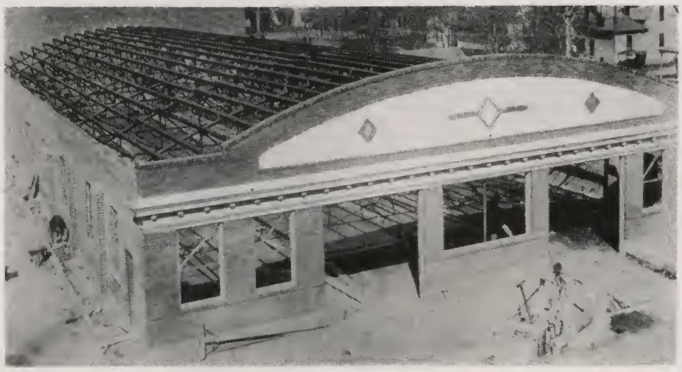
Buckeye Gas Mantle Factory,
Columbus, Ohio

Truscon Steel Joist Construction affords for the small building for light manufacturing the same degree of fireproofness considered so essential to the large modern factories erected throughout the country. Its rigidity and soundproofness insure insulation against vibrating and noisy machinery.

Garages and Service Stations

Conrad Garage Addition, Scranton, Pa.
Edward Langley, Architect
Harry Sykes & Sons, Contractors

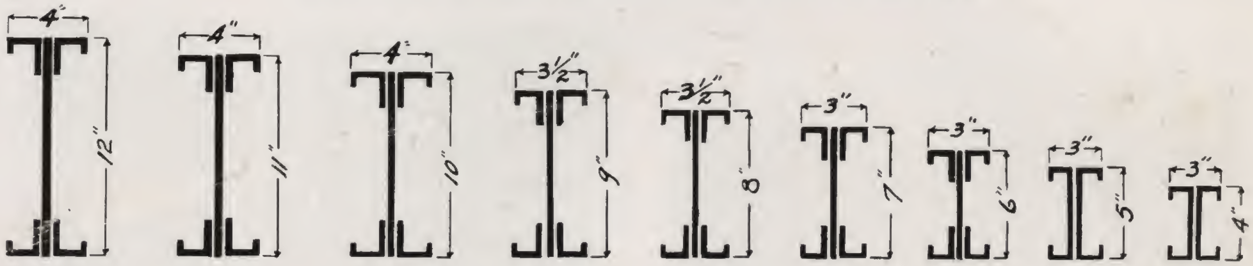
Ford Service Garage,
Rude Automobile Co.,
Marshalltown, Iowa



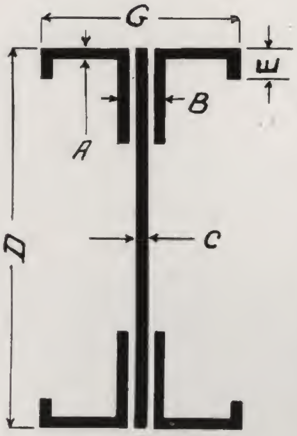
Garage, *Blackwell, Okla.*

The inflammable contents of garages and service stations make fireproofness essential. Additional advantages of Truscon Steel Joist Construction are its rigidity, simplicity and economy.

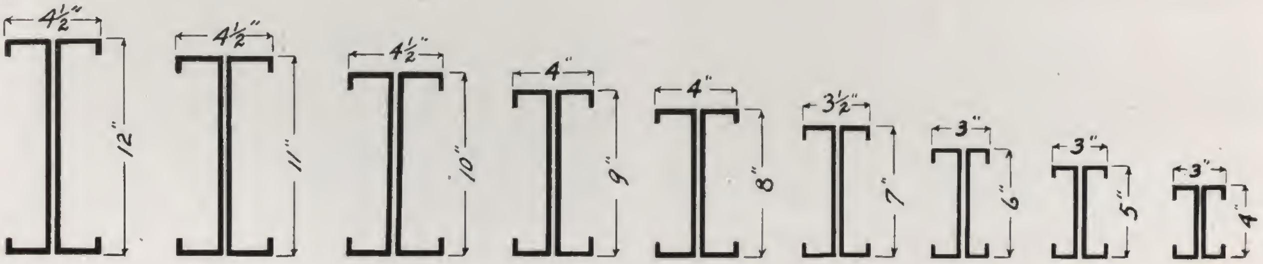
Sections of Truscon Steel Joists



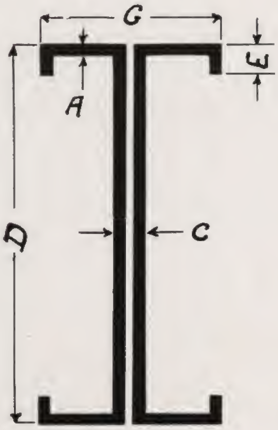
Properties of Plate Girder Joists



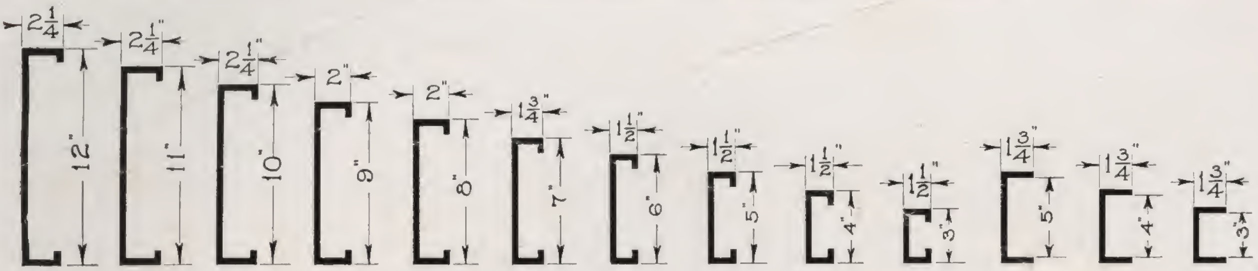
Depth D	Section Index	Weight per ft. Lbs.	Area of Sect. Sq. Ins.	Thickness of Metal Inches			Dimensions of Flanges Inches		Moment of Inertia Ins. 4	Section Modulus Ins. 3	Depth D
				A	B	C	G	E			
4″	B43	3.7	1.08	.072	....	.144	3	½	2.60	1.30	4″
5″	B53	4.2	1.22	.072	....	.144	3	½	4.38	1.75	5″
6″	B63	4.9	1.44	.072	.216	.072	3	½	6.90	2.30	6″
7″	B73	5.4	1.59	.072	.227	.083	3	½	11.20	3.20	7″
8″	B83½	5.9	1.74	.072	.227	.083	3½	½	16.80	4.20	8″
9″	B93½	6.6	1.94	.072	.239	.095	3½	½	23.85	5.30	9″
10″	B104	7.6	2.24	.072	.253	.109	4	½	33.25	6.65	10″
11″	B114	9.0	2.65	.083	.286	.120	4	½	46.20	8.40	11″
12″	B124	10.0	2.94	.083	.300	.134	4	½	60.00	10.00	12″



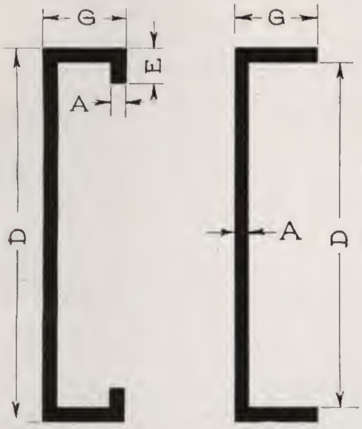
Properties of Double Channel Joists



Depth D	Section Index	Weight per Ft. Lbs.	Area of Sect. Sq. Ins.	Thickness of Metal Inches		Dimensions of Flanges Inches		Moment of Inertia Ins. 4	Section Modulus Ins. 3	Depth D
				A	C	G	E			
4″	N43	3.7	1.08	.072	.144	3	½	2.60	1.30	4″
5″	N53	4.2	1.22	.072	.144	3	½	4.38	1.75	5″
6″	N63	4.7	1.38	.072	.144	3	½	6.90	2.30	6″
7″	N73½	5.5	1.62	.072	.144	3½	⅝	11.20	3.20	7″
8″	N84	6.1	1.80	.072	.144	4	⅝	16.80	4.20	8″
9″	N94	7.0	2.06	.075	.150	4	¾	23.85	5.30	9″
10″	N104½	8.0	2.35	.078	.156	4½	¾	33.25	6.65	10″
11″	N114½	9.5	2.80	.086	.172	4½	¾	46.20	8.40	11″
12″	N124½	10.5	3.10	.090	.180	4½	¾	60.00	10.00	12″

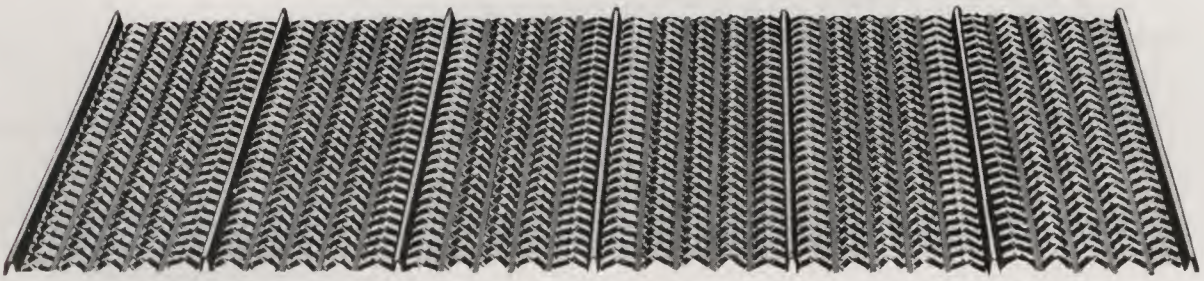


Properties of Steel Channels



C Sections *P Sections*

Depth D	C Sections				P Sections			Depth D
	Thickness of Metal Inch	Width of Flanges Inches		Weight per Foot Lbs.	Thickness of Metal Inch	Flange Width Inches	Weight per Foot Lbs.	
	A	E	G		A	G		
3"	.072	½	1½	1.60	.072	1¾	1.60	3"
4"	.072	½	1½	1.85	.072	1¾	1.85	4"
5"	.072	½	1½	2.10	.072	1¾	2.10	5"
6"	.072	½	1½	2.35				
7"	.072	⅝	1¾	2.75				
8"	.072	⅝	2	3.05				
9"	.075	¾	2	3.50				
10"	.078	¾	2¼	4.00				
11"	.086	¾	2¼	4.75				
12"	.090	¾	2¼	5.25				

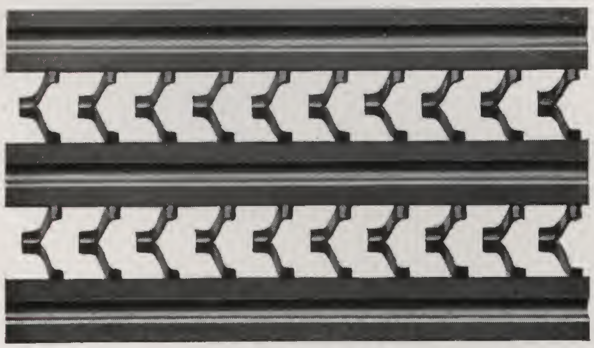


⅜" Hy-Rib Lath

Properties of ⅜" Hy-Rib

Weight Per Sq. Yd.	Joist Spacing for Floors	Joist Spacing for Ceilings	Stud Spacing for Partitions	Cross Sectional Area Per Ft. of Width
3.0 lbs.	12" to 16"	16" to 24"	19" to 24"	.0522 sq. in.
3.5 lbs.	12" to 19"	16" to 24"	24" to 30"	.0610 sq. in.
4.0 lbs.	12" to 24"	24" to 32"	32" to 36"	.0712 sq. in.

Width: 24". Standard Lengths, 6, 8, 10 and 12 feet. Shipped in bundles of 18 sheets.



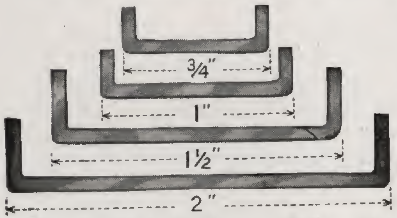
1-A Hy-Rib Lath

Properties of 1-A Hy-Rib Lath

Weight Per Sq. Yd.	Joist Spacing for Ceilings	Stud Spacing for Partitions	Size of Sheets	Sheets Per Bundle	Yards Per Bundle
3.2 lbs.	12" to 24"	16" to 24"	18" x 96"	15	20

Truscon Steel Channels

Used in non-bearing partitions, ceilings, furring, etc.



Size	Wt. lbs. per Ft.
¾"	.276
1 "	.332
1½"	.442
2 "	.553

No. 16 gauge (thickness, .065"). Shipped in bundles of 25 channels. Stock lengths—12, 14, 16, 18 and 20 feet.

Explanation of Safe Loading Tables

The Steel Joist is a light weight member produced by an entirely different method and performs a different function than Rolled Structural Sections. The basis of steel joist design is the same as the well-accepted methods of structural practice and involves no new theories or principles.

In all tables, the strength of the steel joists only is taken into account. No allowance has been made for the greatly added strength given to the joists by the reinforced concrete slab at the top acting as part of the joists.

Bracing All safe loading tables assume the steel joists to be braced laterally. This bracing is taken care of in floor construction by the steel bridging and the steel lath and concrete as called for in the specifications.

Safe Fibre Stress Because of the method of production, which gives the steel extra heating and working, a refined and more compact fibre is secured, resulting in an ultimate strength of 72,000 lbs. per sq. inch with high elastic limit. A fibre stress of 16,000 lbs. per sq. inch is used in all calculations in this handbook, and gives a high factor of safety. In cases where code regulations permit, a fibre stress of 18,000 or 20,000 lbs. per sq. inch is amply safe giving due consideration to deflection limits.

Spacing of Joists To accommodate the 96-inch length of steel lath sheets four common spacings of steel joists have been developed as standard—12″, 16″, 19″ and 24″. The proper spacing of joists to be used is largely a matter of economical design, bearing in mind the use to which the floor is intended. Because of the concentrated loads which may be applied, a garage floor should have the joists spaced as a rule not more than 16″ c-c, while a school house or office building floor can be economically and safely constructed with joists 24″ c-c. Wherever heavy concentrated loads may be applied it is advisable to check into the strength of the floor slab between joists (see table below).

Properties of Sections The properties given are calculated from the exact dimensions as shown on page 10. These properties are the basis of all computations for safe loadings.

Safe Loading Tables A fibre stress of 16,000 lbs. per sq. inch has been used throughout except where correction is made for deflection, page 17. Tables are based on simple spans uniformly loaded. Bending moment $= \frac{1}{8}$ WL. For concentrated loads, cantilever beams or continuous beams, loadings should be corrected as per formulae on Page 16. In all cases the loads shown include dead and live load. For dead load of floor see Page 15.

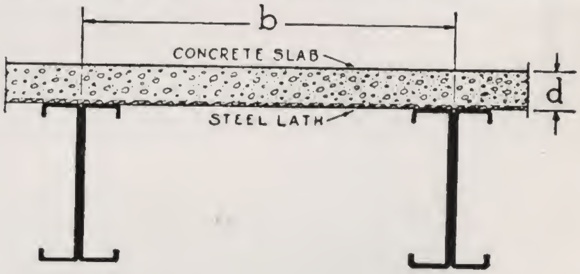
Total Safe Uniform Loads This table shows the total uniformly distributed loads. Heavy lines show theoretical deflection limit of 1/360 of the span (Page 13).

Loads Limited by Deflection None of the loads shown on this table will give a deflection exceeding 1/360 of the span (Page 13).

Loads per Sq. Ft. of Floor Area For convenience in designing these square foot floor load tables have been developed for the four standard joist spacings. All of the loads shown will give a deflection less than 1/360 of the span (Page 14).

Web Crippling Values Safe loads uniformly distributed on the spans given in loading tables will not produce average shearing stresses in the web greater than 10,000 lbs. per sq. inch.

Strength of Slab on Joists



When floors are finished in concrete, tile or the like, the concrete slab over the joists carries the floor loads between joists. These loads may be concentrated as in case of partitions or heavy safes. The table below gives the safe uniform square foot loading and safe concentrated loadings applied between the joists.

Total Safe Loads

W—Live Load per Square Foot Uniformly Distributed.
P—Concentrated Load per Foot of Width.

Slab Thickness	4.0 lb., 3/8″ Hy-Rib. Area of steel per ft. of width (Sq. Ins.)	SPAN OF SLAB (CENTER TO CENTER)							
		12″		16″		19″		24″	
		W	P	W	P	W	P	W	P
2″	.0712	1233	617	688	458	479	379	291	291
2½″	.0712	1560	780	870	580	607	480	370	370
3″	.0712	1890	945	1055	703	735	582	447	447

Concrete in compression not over 550 lbs. per Sq. In.
Steel in tension 16,000 lbs. per Sq. In.
Unit Shear not over 50 lbs. per Sq. In.

Wt. Per Sq. Yd. of 3/8″ Hy-Rib Lath	Area of Steel Per Ft. of Width	For carrying capacity multiply above loads by	Strength as Centering. Joist Spacing
3.0 lbs.	.0522 sq. in.	.73	12″ to 16″
3.5 lbs.	.0610 sq. in.	.85	12″ to 19″
4.0 lbs.	.0712 sq. in.	1.00	12″ to 24″

Total Safe Uniform Loads in Lbs. on Truscon Steel Joists

Deflection Greater than 1/360 of Span for Loads Below Heavy Line

	Size of Steel Joists	4″	5″	6″	7″	8″	9″	10″	11″	12″
Wt. lbs. per ft.	Plate Girder	3.7	4.2	4.9	5.4	5.9	6.6	7.6	9.0	10.0
	Double Chan'l	3.7	4.2	4.7	5.5	6.1	7.0	8.0	9.5	10.5
Clear Span in Feet	6	2311								
	7	1981	2667							
	8	1733	2333	3067						
	9	1541	2074	2726	3793					
	10	1387	1867	2453	3413					
	11	1261	1697	2230	3103					
	12	1155	1555	2045	2845	3733				
	13		1436	1887	2626	3446	4348			
	14		1333	1752	2438	3200	4038			
	15			1635	2275	2986	3769	4729	5973	7111
	16			1533	2133	2800	3533	4433	5600	6666
	17				2008	2635	3325	4172	5271	6275
	18				1896	2489	3141	3940	4978	5926
	19					2358	2975	3733	4716	5614
	20					2240	2827	3546	4480	5333
	21					2133	2692	3378	4267	5079
	22						2570	3224	4073	4848
	23						2458	3084	3896	4638
	24							2955	3733	4445
	25							2837	3584	4267
	26							2728	3446	4102
Maximum Safe Load				3940	4890	3840	4600	5900	6624	8050

Joists braced laterally as in standard floor construction. Bending moment ⅛ WL. Maximum stress 16,000 lbs. per sq. inch

Deflection Limited to 1/360 of Span for All Loads Below

	Size of Steel Joists	4″	5″	6″	7″	8″	9″	10″	11″	12″
Wt. lbs. per ft.	Plate Girder	3.7	4.2	4.9	5.4	5.9	6.6	7.6	9.0	10.0
	Double Chan'l	3.7	4.2	4.7	5.5	6.1	7.0	8.0	9.5	10.5
Clear Span in Feet	6	2311								
	7	1981	2667							
	8	1733	2333	3067						
	9	1380	2074	2726	3793					
	10	1118	1867	2453	3413					
	11	922	1550	2230	3103					
	12	773	1305	2045	2845	3733				
	13		1113	1754	2626	3446	4348			
	14		958	1511	2438	3200	4038			
	15			1318	2135	2986	3769	4729	5973	7111
	16			1159	1880	2800	3533	4433	5600	6666
	17				1669	2500	3325	4172	5271	6275
	18				1481	2225	3141	3940	4978	5926
	19					2000	2844	3733	4716	5614
	20					1800	2562	3546	4480	5333
	21					1637	2322	3250	4267	5079
	22						2120	2942	4073	4848
	23						1937	2700	3752	4638
	24							2475	3446	4445
	25							2285	3181	4133
	26							2115	2930	3820
Maximum Safe Load				3940	4890	3840	4600	5900	6624	8050

Joists braced laterally as in standard floor construction. Bending moment ⅛ WL. Maximum stress 16,000 lbs. per sq. in.

Total Safe Uniform Loads on Truscon Steel Joists in Pounds per Square Foot of Floor Area

Joists spaced 24″ center to center

Clear Span in Ft.	Depth of Joists in Inches								
	4	5	6	7	8	9	10	11	12
6	193	......	......	......	......	......	......	......	......
7	142	191	......	......	......	......	......	......	......
8	108	146	192	......	......	......	......	......	......
9	77	115	152	211	......	......	......	......	......
10	56	94	123	171	......	......	......	......	......
11	42	70	102	141	......	......	......	......	......
12	32	54	85	119	156	......	......	......	......
13	......	43	67	101	133	167	......	......	......
14	......	34	54	87	115	144	......	......	......
15	......	......	44	71	100	126	158	199	237
16	......	......	37	59	88	111	139	175	209
17	......	......	......	49	74	98	123	155	185
18	......	......	......	41	62	88	110	139	165
19	......	......	......	......	53	75	99	124	148
20	......	......	......	......	45	64	89	112	134
21	......	......	......	......	39	56	78	102	121
22	......	......	......	......	......	48	67	93	110
23	......	......	......	......	......	42	59	82	101
24	......	......	......	......	......	......	52	72	93
25	......	......	......	......	......	......	46	64	83
26	......	......	......	......	......	......	41	57	74

Joists spaced 19″ center to center

Clear Span in Ft.	Depth of Joists in Inches								
	4	5	6	7	8	9	10	11	12
6	244	......	......	......	......	......	......	......	......
7	179	240	......	......	......	......	......	......	......
8	137	184	241	......	......	......	......	......	......
9	97	146	191	266	......	......	......	......	......
10	71	118	155	216	......	......	......	......	......
11	53	89	128	178	......	......	......	......	......
12	40	69	107	149	196	......	......	......	......
13	......	54	85	127	167	211	......	......	......
14	......	43	68	110	145	182	......	......	......
15	......	......	55	90	126	159	199	252	299
16	......	......	46	74	110	140	175	221	263
17	......	......	......	62	93	124	155	196	233
18	......	......	......	52	78	110	138	175	208
19	......	......	......	......	66	95	124	157	186
20	......	......	......	......	57	81	112	141	169
21	......	......	......	......	49	70	98	128	153
22	......	......	......	......	......	61	85	117	139
23	......	......	......	......	......	53	74	103	127
24	......	......	......	......	......	......	65	91	117
25	......	......	......	......	......	......	57	80	104
26	......	......	......	......	......	......	51	71	93

Joists spaced 16″ center to center

Clear Span in Ft.	Depth of Joists in Inches								
	4	5	6	7	8	9	10	11	12
6	289	......	......	......	......	......	......	......	......
7	212	286	......	......	......	......	......	......	......
8	163	219	287	......	......	......	......	......	......
9	116	173	227	316	......	......	......	......	......
10	84	140	184	256	......	......	......	......	......
11	63	106	152	212	......	......	......	......	......
12	48	82	128	178	234	......	......	......	......
13	......	64	101	152	199	251	......	......	......
14	......	51	81	130	172	216	......	......	......
15	......	......	66	107	150	188	236	299	356
16	......	......	54	88	131	166	208	262	313
17	......	......	......	74	110	147	184	232	277
18	......	......	......	62	93	131	164	208	247
19	......	......	......	......	79	113	147	186	221
20	......	......	......	......	68	96	133	168	200
21	......	......	......	......	58	83	116	152	182
22	......	......	......	......	......	72	101	139	165
23	......	......	......	......	......	63	88	123	151
24	......	......	......	......	......	......	77	108	139
25	......	......	......	......	......	......	68	95	124
26	......	......	......	......	......	......	61	85	110

Joists spaced 12″ center to center

Clear Span in Ft.	Depth of Joists in Inches								
	4	5	6	7	8	9	10	11	12
6	385	......	......	......	......	......	......	......	......
7	283	381	......	......	......	......	......	......	......
8	217	292	383	......	......	......	......	......	......
9	154	231	303	421	......	......	......	......	......
10	112	187	245	341	......	......	......	......	......
11	84	141	203	282	......	......	......	......	......
12	64	109	170	237	311	......	......	......	......
13	......	86	134	202	265	334	......	......	......
14	......	68	108	174	229	288	......	......	......
15	......	......	88	142	199	251	315	398	474
16	......	......	73	118	175	221	277	350	417
17	......	......	......	98	147	196	246	310	369
18	......	......	......	82	124	175	219	277	329
19	......	......	......	......	105	150	197	248	295
20	......	......	......	......	90	128	177	224	267
21	......	......	......	......	78	111	155	203	242
22	......	......	......	......	......	96	134	185	220
23	......	......	......	......	......	84	117	164	202
24	......	......	......	......	......	......	103	144	185
25	......	......	......	......	......	......	91	127	165
26	......	......	......	......	......	......	81	113	147

Above loads include dead weight of floor construction and ceiling, averaging about 40 pounds per square foot. To find the safe live load, deduct the dead load from these values. The maximum deflection is less than 1/360 of the span. All values are for joists braced laterally as in standard floor construction. Tables are based on bending moment of ⅛ WL and maximum fibre stress of 16,000 lbs. per square inch.

Weight of Truscon Steel Joist Floor Construction

The dead weight of floor construction will vary according to the nature of materials used for floor finish. Below is given the average weight of standard Steel Joist floor having wood floor finish applied directly to wood nailing strips—

Wood Flooring	3 lbs.
1¾ inches Concrete	21 lbs.
Steel Joists and Bridging (Average)	4 lbs.
Plaster Ceiling and Lath	8 lbs.
Total Weight per sq. ft.	36 lbs.

In determining the average weight of steel joists, 9″ sections spaced 24″ on centers were assumed.

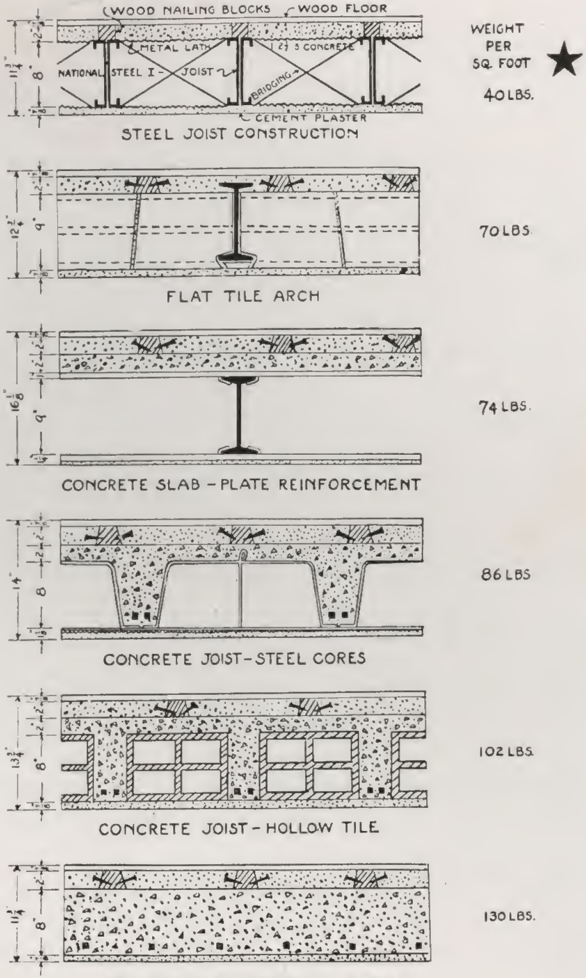
Cement, Terrazo or Tile floor finishes increase the dead weight of floor to some extent. Usually the total thickness over joists, including the concrete fill and finish, averages 2½ inches, which would increase the total weight of floor construction, after first deducting weight of wood flooring, to 42 lbs. per square foot.

Proper correction in the above table should be made according to size and spacing of joists and nature of floor finish required in the design.

Forty pounds can be safely assumed as the dead load per square foot of finished Steel Joist floor construction. A difference of a few pounds per square foot over an extended floor area is of sufficient importance to warrant actual computation of dead load.

Some of the common types of floor construction are shown opposite. Note the great saving in weight of Steel Joist Construction. Consider the saving that is made in the supporting framework and foundations, as well as in the floor itself.

COMPARISON OF WEIGHT PER SQUARE FOOT VARIOUS FIREPROOF FLOOR CONSTRUCTIONS WORKED OUT FOR SAME LOADING AND SPAN



STEEL JOIST CONSTRUCTION

FLAT TILE ARCH

CONCRETE SLAB - PLATE REINFORCEMENT

CONCRETE JOIST - STEEL CORES

CONCRETE JOIST - HOLLOW TILE

REINFORCED CONCRETE SLAB

Weight of Truscon Steel Joists per Square Foot of Floor Area for Various Spacings of Joists

Plate Girder Joists	Lin. Ft. of Joist per Sq. Ft. Floor Area				Plate Girder Joists
	1.0	.75	.632	.50	
	Steel Joist Spacing				
	12″	16″	19″	24″	
	Pounds of Joist per Sq. Ft. Floor Area				
4″	3.70	2.78	2.34	1.85	4″
5″	4.20	3.15	2.66	2.10	5″
6″	4.90	3.68	3.10	2.45	6″
7″	5.40	4.05	3.41	2.70	7″
8″	5.90	4.43	3.73	2.95	8″
9″	6.60	4.95	4.17	3.30	9″
10″	7.60	5.70	4.80	3.80	10″
11″	9.00	6.75	5.68	4.50	11″
12″	10.00	7.50	6.32	5.00	12″

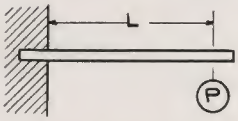
Double Channel Joists	Lin. Ft. of Joist per Sq. Ft. Floor Area				Double Channel Joists
	1.0	.75	.632	.50	
	Steel Joist Spacing				
	12″	16″	19″	24″	
	Pounds of Joist per Sq. Ft. Floor Area				
4″	3.70	2.78	2.34	1.85	4″
5″	4.20	3.15	2.66	2.10	5″
6″	4.70	3.53	2.97	2.35	6″
7″	5.50	4.13	3.48	2.75	7″
8″	6.10	4.58	3.86	3.05	8″
9″	7.00	5.25	4.42	3.50	9″
10″	8.00	6.00	5.05	4.00	10″
11″	9.50	7.13	6.00	4.75	11″
12″	10.50	7.88	6.64	5.25	12″

In estimating total weight of steel joist in a floor, figure area to include full length of joist.

Bending Moments and Deflection of Beams for Usual Methods of Loading

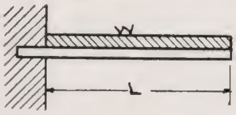
P & W = Total Load
L = Length of Net Span
M = Maximum Bending Moment
I = Moment of Inertia
E = Modulus of Elasticity
S = Maximum Shear

Beam Fixed at One End and Loaded at Other



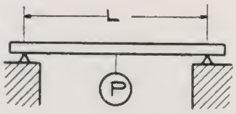
Safe load = $\frac{1}{8}$ that shown in tables
$M = PL$ at point of support
$S = P$ at point of support
Deflection = $\frac{PL^3}{3EI}$

Beam Fixed at One End and Uniformly Loaded



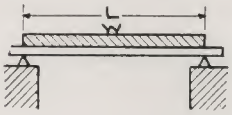
Safe load = $\frac{1}{4}$ that shown in tables
$M = \frac{WL}{2}$ point of support
$S = W$ point of support
Deflection = $\frac{WL^3}{8EI}$

Beam Supported at Both Ends, Single Load in Middle



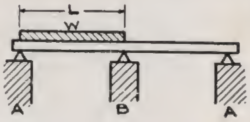
Safe load = $\frac{1}{2}$ that shown in tables
$M = \frac{PL}{4}$ middle of beam
$S = \frac{P}{2}$ at points of support
Deflection = $\frac{PL^3}{48EI}$

Beam Supported at Both Ends and Uniformly Loaded



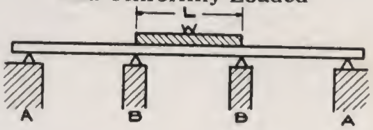
Safe load = that shown in tables
$M = \frac{WL}{8}$ at middle of beam
$S = \frac{W}{2}$ at points of support
Deflection = $\frac{5WL^3}{384EI}$

Beam Continuous Over Support at One End Uniformly Loaded



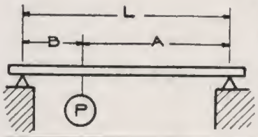
Safe load = $1\frac{1}{8}$ that shown in tables
$M = \frac{WL}{9}$ at middle of beam
$S = \frac{W}{2}$ at points of support
Deflection = $\frac{3WL^3}{384EI}$

Beam Continuous Over Support at Both Ends and Uniformly Loaded



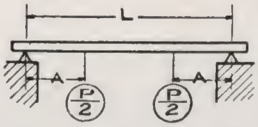
Safe load = $1\frac{1}{4}$ that shown
$M = \frac{WL}{10}$ at middle of beam
$S = \frac{W}{2}$ at point of support
Deflection = $\frac{WL^3}{384EI}$

Beam Supported at Both Ends—Single Unsymmetrical Load



Safe load = that given in tables $\times \frac{L^2}{8AB}$
$M = \frac{PAB}{L}$ under load
S = A End = $\frac{PB}{L}$ B End = $\frac{PA}{L}$
Deflection = $\frac{PAB(2L-A)}{9EIL}\sqrt{\frac{1}{3}A(2L-A)}$

Beam Supported at Ends—Two Symmetrical Loads



Safe load = that shown in tables $\times \frac{L}{4A}$
$M = \frac{PA}{2}$ between loads
$S = \frac{P}{2}$ bet. load & nearest support
Deflection = $\frac{PA}{48EI}(3L^2-4A^2)$

Weight of Building Materials

Material and Purpose for Which Used	Wt. in Lbs. per Sq. Ft.
Floors	
⅞″ Oak finish flooring	3⅔
⅜″ Oak finish flooring	1⅔
⅞″ Maple finish flooring	3
⅜″ Maple finish flooring	1½
Yellow Pine sheathing—1″ thick	4
Stone Concrete fill per inch of thickness	12
Cinder Concrete fill per inch of thickness	9
Asphalt Mastic flooring 1½″ thick	18
Cement or Terrazo finish per inch of thickness	13
Solid Flat Tile on 1″ mortar bed	23
Ceilings	
Plaster on Tile or Concrete	6
Plaster on Metal Lath	7
Metal Lath	⅓
Suspended Metal Lath and Plaster	9
Roofs	
Yellow Pine sheathing 1″ thick	4
Slate ¼″ thick	9
Cement Tile	16
Cinder Fill per inch thickness	3½
Three Ply Ready Roofing	1
Four Ply Felt and Gravel	5½
Five Ply Felt and Gravel	6

Material and Purpose for Which Used	Wt. in Lbs. per Sq. Ft.
Walls	
9″ Brick Wall—unplastered	84
13″ Brick Wall—unplastered	121
18″ Brick Wall—unplastered	168
22″ Brick Wall—unplastered	205
26″ Brick Wall—unplastered	243
4″ Brick 4″ Tile Backing—unplastered	60
4″ Brick 8″ Tile Backing—unplastered	75
9″ Brick 4″ Tile Backing—unplastered	102
8″ Tile—unplastered	33
12″ Tile—unplastered	45
Plaster on Brick or Tile Walls—one side	5
Partitions	
3″ Clay Tile—both sides plastered	27
4″ Clay Tile—both sides plastered	28
6″ Clay Tile—both sides plastered	35
8″ Clay Tile—both sides plastered	41
3″ Gypsum Block — both sides plastered	20
4″ Gypsum Block — both sides plastered	22
5″ Gypsum Block — both sides plastered	24
6″ Gypsum Block — both sides plastered	26
2″ Solid Plaster	20
4″ Hollow Plaster	22

Masonry

Kind	Wt. in Lbs. per Cu. Ft.
Concrete, cinder	110
Concrete, stone	144
Concrete, reinforced stone	150
Brick, masonry, soft	100
Brick, masonry, common	125
Brick, masonry, pressed	140
Granite, dressed	165
Marble	165
Limestone	162
Sandstone	150

Miscellaneous

Kind	Weight lbs.
Cement, Portland, per barrel	376
Cement, Portland, per cubic foot	85 to 90
Lime, per barrel	225
Sand, per cubic foot	90to 106
Gravel, per cubic foot	120
Cinders, per cubic foot	40
Dimension Lumber, per foot B. M.	3
Iron, per cubic foot	480
Steel, per cubic foot	489.6
Water, at 32° F., per cubic foot	62.417

Coefficients for Deflection

Beams Subjected to Maximum Safe Loading Uniformly Distributed.

Fibre Stress 16000 lbs. per sq. in.

Clear Span in Feet	Coef-ficient	Clear Span in Feet	Coef-ficient	Clear Span in Feet	Coef-ficient	Clear Span in Feet	Coef-ficient	Clear Span in Feet	Coef-ficient	Clear Span in Feet	Coef-ficient
1	.0166	11	2.0028	21	7.2993	31	15.9062	41	27.8234	51	43.0510
2	.0662	12	2.3834	22	8.0110	32	16.9490	42	29.1972	52	44.7559
3	.1490	13	2.7972	23	8.7559	33	18.0248	43	30.6041	53	46.4938
4	.2648	14	3.2441	24	9.5338	34	19.1338	44	32.0441	54	48.2648
5	.4138	15	3.7241	25	10.3448	35	20.2759	45	33.5172	55	50.0690
6	.5959	16	4.2372	26	11.1890	36	21.4510	46	35.0234	56	51.9062
7	.8110	17	4.7834	27	12.0662	37	22.6593	47	36.5628	57	53.7766
8	1.0593	18	5.3628	28	12.9766	38	23.9007	48	38.1352	58	55.6800
9	1.3407	19	5.9752	29	13.9200	39	25.1752	49	39.7407	59	57.6166
10	1.6552	20	6.6207	30	14.8966	40	26.4828	50	41.3793	60	59.5862

The above coefficients are for use in obtaining the deflection of steel shapes subjected to transverse strain, under their uniformly distributed total safe loads for extreme fibre stresses of 16,000 pounds per square inch; the modulus of elasticity being 29,000,000.

To find the deflection of any shape that is symmetrical about its neutral axis under the above conditions of loading when used as a beam, such as I-Beams, Channels, etc., divide the coefficient in the table corresponding to the given span and fibre stress, by the depth of the beam in inches. The result will be the deflection in inches.

To find the deflection of any shape that is unsymmetrical about its neutral axis when used as a beam, under the above conditions of loading, such as T-Bars, Angles, etc., divide the coefficient in the table corresponding to the given span by twice the distance of the most remote fibre from the neutral axis, expressed in inches.

The deflections obtained as above described are the total deflections due to the weight of the beam itself and the superimposed safe load uniformly distributed.

Safe Unit Fibre Stress Limited by Deflection

Stresses in lbs. per sq. in., to be used in determining total uniform loading for maximum deflection of 1/360 of span.

For spans less than those indicated use 16000 lbs. per sq. in.

Beam Size Inches	SPAN IN FEET															
	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
4	14400	12900	11700	10700												
5		16000	14600	13400	12400	11500										
6				16000	14800	13800	12900	12100								
7						16000	15000	14100	13300	12500						
8								16000	15200	14300	13600	12800				
9										16000	15300	14500	13800	13200		
10												16000	15400	14600	14000	13400

Beam Size Inches	SPAN IN FEET															
	23	24	25	26	27	28	31	32	33	34	37	38	40	41	42	44
10	14000	13400														
11	15500	14300	14200	13600	13100											
12		16000	15500	14900	14300	13800										
15						16000	15600	15100	14700	14200						
18										16000	15700	15300	14500			
20													16000	15700	15300	14700

NOTE: Stresses given to nearest 100 pounds per sq. in.

Specifications for Truscon Steel Joists

General Where steel joist floor construction is specified, it is understood to mean steel joists of the size, weight and spacing shown or required, together with a structural concrete slab over the joists, and unless otherwise specified, a plaster ceiling directly beneath the joists, both floor slab and ceiling being supported by steel lath firmly connected to the joists.

Steel joists are to be made of shapes, rolled from steel, spot welded together to form sections of proper design to carry the required loads. Joists shall not be spliced within their unsupported length. The thickness of the steel shall not be less than .072 inch (No.15 gauge Birmingham). In calculating the design of the section a maximum fiber stress of 16,000 pounds per square inch shall be used. If prongs or holes occur, the sectional area must be reduced by the cross-sectional area of the hole. All joists shall receive one dip coat of high grade steel preservative paint before shipment. Spacing of joists shall not exceed 24 inches on centers for floors and 30 inches for roofs.

Slab Reinforcement For centering and slab reinforcement, a steel lath equal to Truscon Hy-Rib shall be securely attached to the top flange of the joists at intervals not greater than 12 inches. The lath must be so placed that the ribs run at right angles to the joists, and the flat mesh between the ribs is in contact with the top flange of the joist. Weights of ⅜″ Hy-Rib indicated in the following must be used:
4.0 lb., ⅜″ Hy-Rib for joist spacings from 12″ to 24″
3.5 lb., ⅜″ Hy-Rib for joist spacings from 12″ to 19″
The lath sheets must lap at least 2 inches when the laps occur over a joist, otherwise, the lap must be 8 inches, and the ends of both sheets must be wired.

Roofs When steel joists are used in flat roof construction, i. e. in roofs having a pitch of not more than ½ inch to the foot, the same specifications as for floors will be used. When steel joists are used as rafters in a pitch roof, proper bearing should be provided at the ridge and eave, and the joists securely bolted into the supporting members or walls. When steel joists are used as purlins on a pitched roof, each joist must be bolted to the supporting member, and stay rods or braces placed so as to resist all overturning moment.

Bridging When steel joists are used in either roof or floor construction, the joists must be bridged by tension bridging at intervals of not more than 6 feet apart, and with a row of bridging placed not more than 3 feet from the ends of the joists.

Slab Concrete Structural concrete for floor or roof slab shall consist of one part of cement, two parts sand and four parts gravel, crushed stone or slag. Where wood flooring is used, the thickness of the concrete between the nailing screeds shall not be less than 1½ inches. When the floor is to have a cement finish and the finish is poured integrally with the structural slab, and floated to a smooth surface, the total slab shall be at least 2 inches in thickness. The structural concrete shall be what is known as a dry mix. Plank runways shall be used if the concrete is conveyed in wheel barrows and the mix shall be dumped over a joist and spread over the surface evenly so that no concentrated loads will be applied on the lath sufficient to cause a sag.

Finished Flooring Wood finished floors shall be secured to steel joists by means of nailing screeds, laid on top of the metal lath over the center of the joists and fastened to the joists by screed clips at intervals of not more than 16 inches. If finished flooring is less than 1 inch thick and nailed directly to the screeds, spacing of joists shall not be more than 20 inches. If sub-floor or 1⅝″ finished flooring is used, joist spacing may be 24 inches. The screeds shall be of proper height to come just above the concrete slab, and shall be slightly bevelled. The greatest width of the screed at the bottom shall allow a shoulder of concrete over the edge of the joist of not less than ½ inch. A structural slab of 1:2:4 concrete shall then be placed in between the screeds and floated to a smooth surface just below the top of the screed. If a nailing concrete or similar floor slab is used, the joists may be spaced up to 24 inches on centers.

When finished floor is to be cement, terrazo, tile or marble, 7-32 inch temperature rods must be imbedded in the structural concrete slab running parallel to the joists, and spaced not more than 18 inches apart on centers.

Structural Supports When steel joists are supported by structural steel shelf angles or on top of structural shapes, they shall have a minimum bearing of 2½ inches; when supported by brick walls, a minimum bearing of 4 inches, and when supported by reinforced concrete a minimum bearing of two inches in the stem of a Tee Beam or lintel.

All structural steel used for supporting steel joists shall be so designed as to take all wind load.

For framing around large openings such as elevators, enclosures or stair wells, the framing shall be structural steel shapes or reinforced concrete. For framing around small vent shafts or similar openings, steel joists may be used; all punching, notching, bolting, etc. being done in the field.

Brick walls for supporting steel joists shall be self supporting, and be designed so that joist floors will not be called upon to take compressive or tensile stress. When steel joists are imbedded in brick walls the brick shall be so laid as not to throw a concentrated shear load upon the end of the joist. A pocket should be left in the brick work for the joist and the end shall be imbedded in grout.

Care should be taken to see that grout is forced between the end of the joist and the outside brick. To avoid the necessity of leaving pockets in the brick, the walls may be corbeled out six inches to form a bearing for the end of the joists, and the top lath anchored into the wall between horizontal courses of brick by raking out the mortar.

Wind Stress If the design of the building makes it necessary to use the steel joist floor slab for wind stress, the ends of every fourth joist must be anchored into the brick by means of a ½ inch rod placed thru, and centering on a hole in the web of the joist. The rod must be at least 8 inches long, and securely anchored between vertical brick courses. If the other end rests on structural steel, every anchored joist must be rigidly connected to the structural member by means of bolts thru the bottom flanges of the joist.

Ceilings For ceilings attached in contact with steel joists metal lath shall not weigh less than the following for joist spacings indicated:

12″ joist spacing: flat lath, 3.0 lbs. per sq. yd.
16″ joist spacing: flat lath, 3.4 lbs. per sq. yd.
19″ joist spacing: 1-A Hy-Rib lath, 3.2 lbs. per sq. yd.
19″ joist spacing: ⅜″ Hy-Rib lath, 3.0 lbs. per sq. yd.
24″ joist spacing: ⅜″ Hy-Rib lath, 3.5 lbs. per sq. yd.
30″ joist spacing: ⅜″ Hy-Rib lath, 4.0 lbs. per sq. yd.

Truscon Metal Lath shall be securely attached to the joists at intervals of not over 8 inches. The ribs must run at right angles to the joists. The lath must be placed with the ribs up. End laps of 2 inches shall be used when the lap occurs at the joist, otherwise the sheets must be lapped 8 inches and both ends wired.

For a suspended ceiling, wire hangers of not less than 14 gauge galvanized wire shall be looped entirely around the joists and twisted so that the hanger cannot become loose from the joist. To these hangers shall be attached cold rolled channels, running at right angles to each other and of proper size and weight to carry the ceiling lath without deflection. Metal Lath shall not weigh less than previously specified for ceilings attached in direct contact with steel joists. All lath must be dip painted at factory before shipment.

Non-bearing Partitions When steel stud partitions are specified, they are to be non-bearing.

For hollow non-bearing partitions, studs shall be of the gauge, size and weight as called for or required. Where specified, studs may consist of two ¾″ cold rolled steel channels weighing not less than .276 lbs. per lineal foot and rigidly connected about every three feet by spacing clips.

For solid non-bearing partitions, studs shall be ¾″ cold rolled steel channels weighing not less than .276 lbs. per lineal foot. Channels shall be attached by bending a shoe at each end and wiring, nailing or bolting to floor or ceiling construction. If not bent, channels shall be inserted in holes provided in the construction for the purpose.

For all partitions, metal lath shall not weigh less than the following for stud spacings indicated:

12″ stud spacing: flat lath, 2.2 lbs. per sq. yd.
16″ stud spacing: flat lath, 2.5 lbs. per sq. yd.
24″ stud spacing: 1-A Hy-Rib lath, 3.2 lbs. per sq. yd.
24″ stud spacing: ⅜″ Hy-Rib lath, 3.0 lbs. per sq. yd.
30″ stud spacing: ⅜″ Hy-Rib lath, 3.5 lbs. per sq. yd.
36″ stud spacing: ⅜″ Hy-Rib lath, 4.0 lbs. per sq. yd.

For hollow partitions, attach metal lath placed horizontally to both sides of studs; for solid partitions, to one side of studs only.

If flat lath is used, end laps over studs and all side laps must be at least 2 inches. End splices occurring between studs must have a lap of 6 inches and be securely wired together. If stud spacing is over 16 inches flat lath must be wired at side lap between studs. Ribbed lath must be placed with the ribs against the studs.

Floor Concrete Omitted Where steel joists are specified without concrete and metal lath over them, nailing screeds shall be secured to steel joists by screed clips and building felt laid between screeds and joists. Where screeds are laid over centers of joists, spacings of joists shall not exceed 19 inches for single flooring less than 1 inch thick, and 24 inches for double flooring or 1⅝ inch single flooring. Nailing screeds or stringers laid at right angles to joists shall be of sufficient strength to support the floor loads without undue deflection, and joists may be spaced up to 48 inches on centers. Bridging and ceilings shall be constructed as previously specified.

Installation of Truscon Steel Joists

Steel Joists leave the factory cut to proper length ready for installation. They should be placed in accordance with erection diagram previously prepared. All joists should have level bearing and be set in a true, upright position.

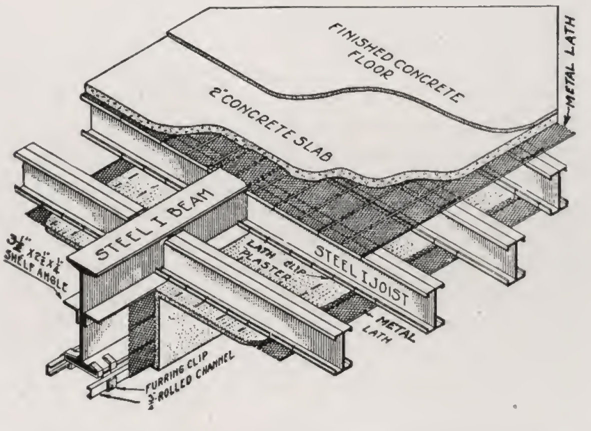
Temporary wood strips, approximately 1″ x 2″, are placed at right angles to the joists and secured to them, one strip at each end and one over each line of bridging. These strips are to temporarily hold joists rigidly in line. Bridging is next installed as described on Page 21.

The floor is now sufficiently rigid to work upon. Temporary sheathing may be laid over the joists and other work of the building carried on. Do not place floor lath until shortly before ready to lay concrete, as it may be damaged.

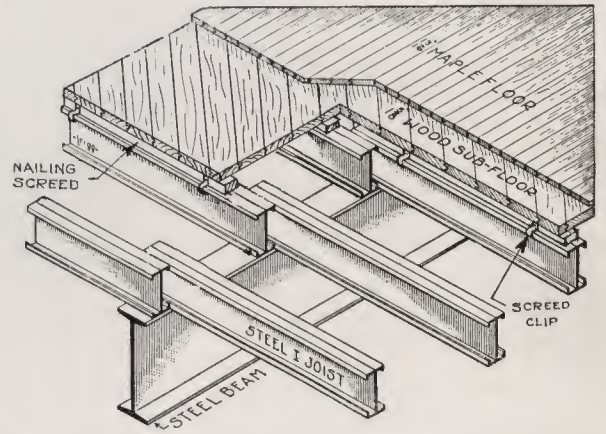
Take up temporary wood strips and immediately lay the metal lath over the steel joists. For wood flooring nailing screeds are placed over the center lines of joists and attached with screed clips. For cement, tile or terrazo finish the metal lath is attached to the steel joists with hook staples or lath clips. Next place the concrete using a comparatively dry, rich mixture.

Attach ceiling lath to under side of joists with hook staples or lath clips and apply plaster.

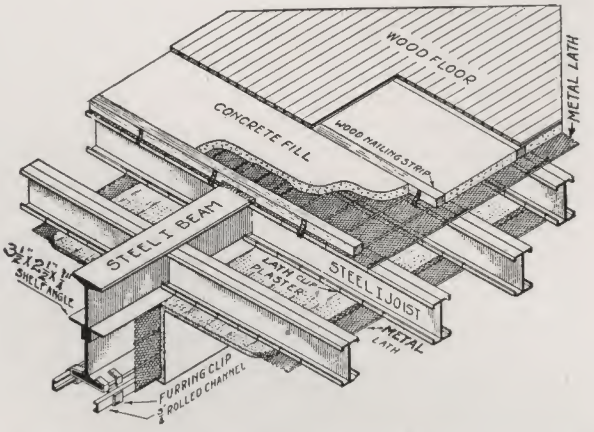
Floor and Partition Details



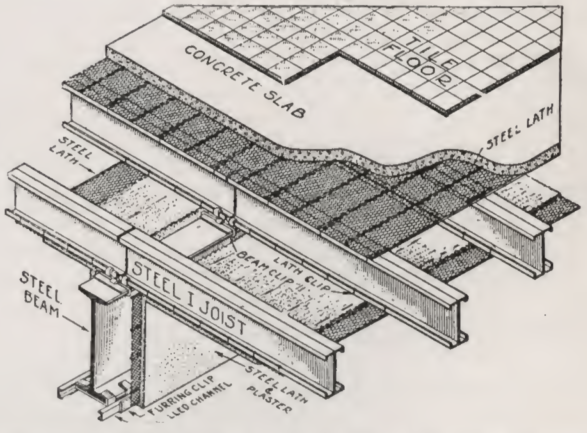
Steel joists supported by shelf angles on structural steel beam. Cement floor finish.



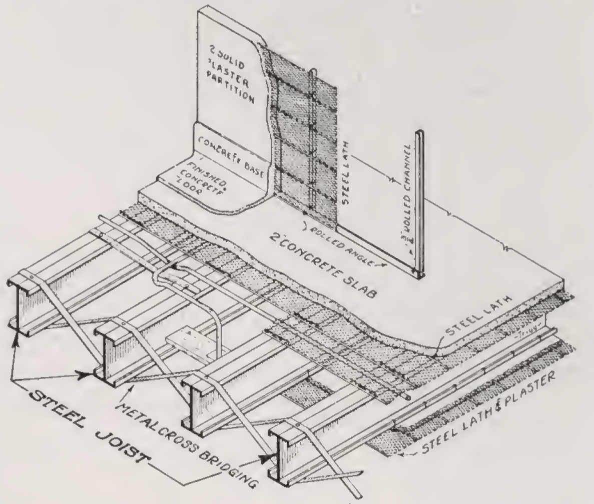
Wood floor and screeds secured directly to joists by screed clips. Floor concrete and metal lath omitted.



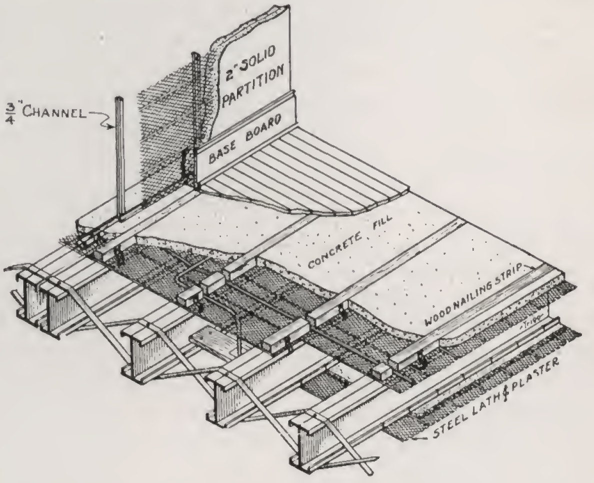
Steel joists supported by shelf angles on structural steel beam. Wood floor finish.



Steel joists secured to top of steel beams by joist clips. Tile floor finish.

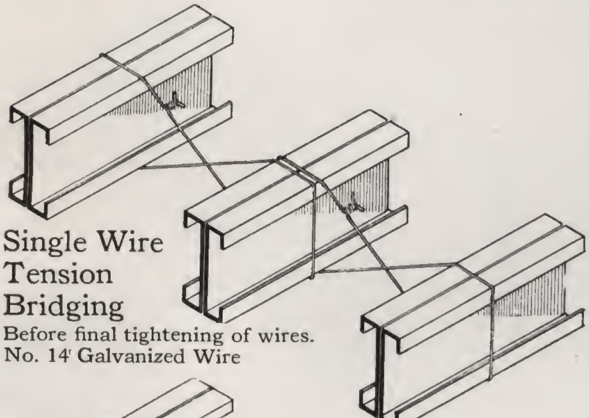


Two inch solid, non-bearing partition at right angles to joists; plaster on metal lath and channels. Cement or tile floor finish.



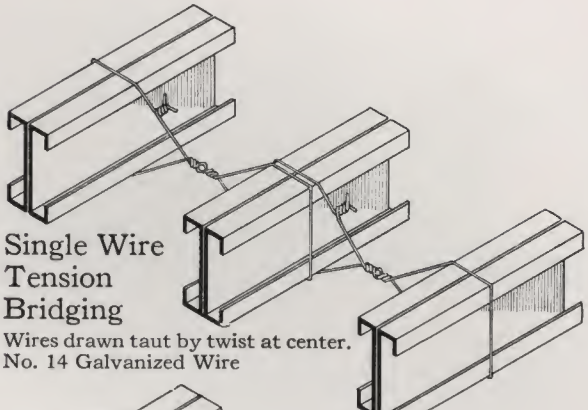
Two inch solid non-bearing partition parallel to joists; plaster on metal lath and channels. Wood floor finish.

Bridging for Steel Joists



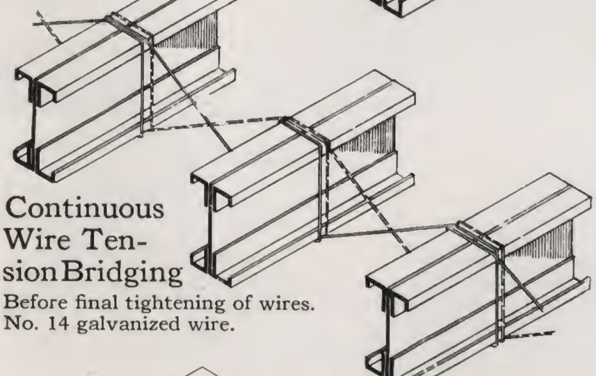
Single Wire Tension Bridging

Before final tightening of wires.
No. 14 Galvanized Wire



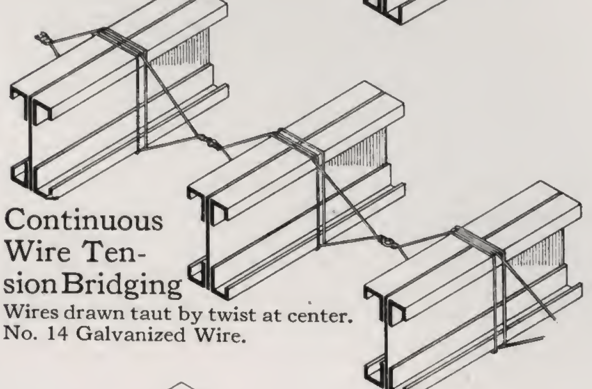
Single Wire Tension Bridging

Wires drawn taut by twist at center.
No. 14 Galvanized Wire



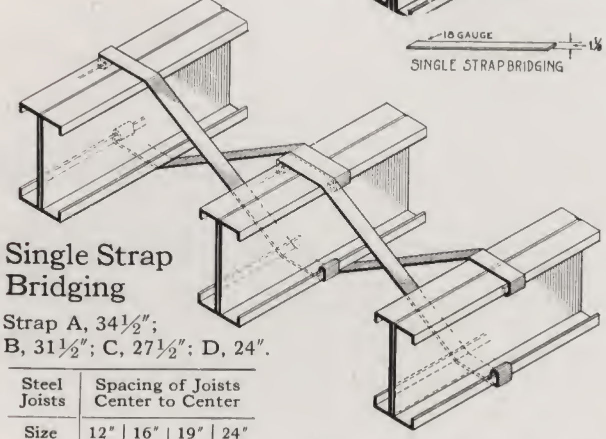
Continuous Wire Tension Bridging

Before final tightening of wires.
No. 14 galvanized wire.



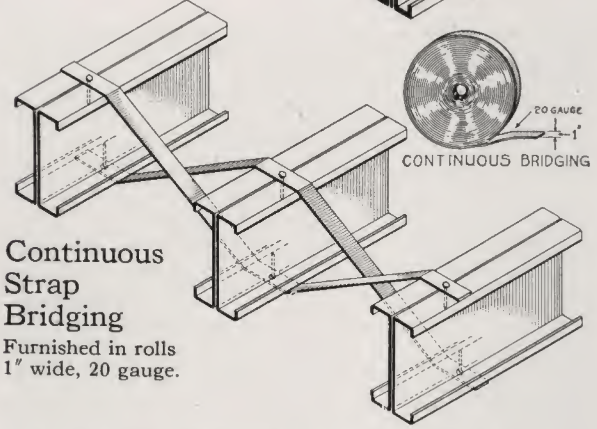
Continuous Wire Tension Bridging

Wires drawn taut by twist at center.
No. 14 Galvanized Wire.



Single Strap Bridging

Strap A, 34½″;
B, 31½″; C, 27½″; D, 24″.



Continuous Strap Bridging

Furnished in rolls
1″ wide, 20 gauge.

Steel Joists	Spacing of Joists Center to Center			
Size	12″	16″	19″	24″
4	D	D	C	B
5	D	D	C	B
6	D	D	C	B
7	D	D	C	B
8	D	C	C	A
9	D	C	B	A
10	D	C	B	A
10	C	C	B	A
11	C	B	B	A
12	C	B	B	A

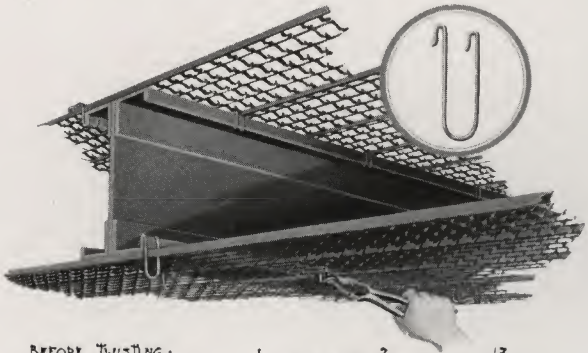
When ordering give designation letter as Strap "A". Furnished in No. 18 Ga. Black Steel.

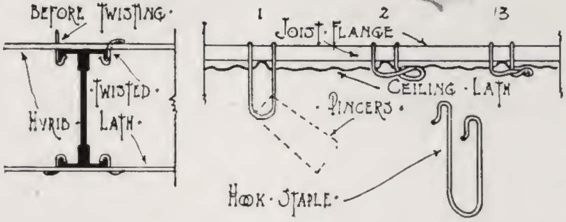
There have been many types of bridging used with Steel Joists but the commonly accepted types are shown above. Bridging to fulfill the requirements must be inexpensive in both application and material. It must have sufficient strength to aid in distributing any unusual loads which are sometimes applied during the course of erection only, as after the floor and ceiling are applied the floor and ceiling slab perform this function. It must be capable of being put into tension.

The wire types fulfill all of these functions and are entirely satisfactory. The single strap type gives additional strength but its cost is proportionately greater than the wire types.

The flat continuous type is shown because it has been frequently used in the past. It is not recommended because it is quite difficult to put into actual tension and because it requires nails both top and bottom to have it hold the joists firmly in position. Nailing to joists is not recommended because the nails distort the top flange, are difficult to drive and to apply require scaffolding below.

Hook Staples



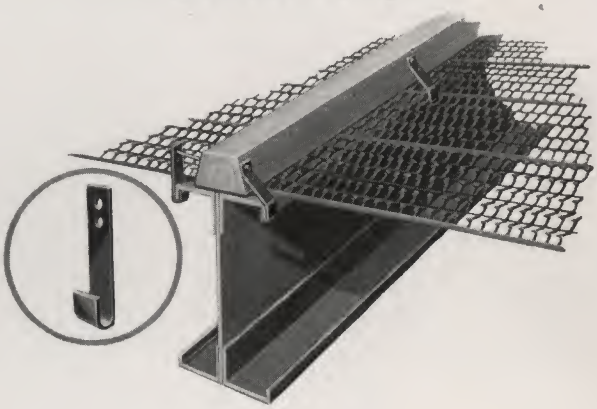


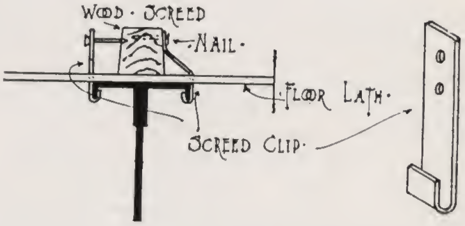
This staple forms a positive connection between the floor or ceiling lath, and the joist when applied as shown in the successive operations numbers one, two and three. This operation pulls the staples up close to the mesh of the lath which prevents any interference with the plasterer's trowel.

Applying the Staple

In the first operation the pinchers grasp the Hook Staple at an angle of about 45 degrees, and force the hooks over the rib of the Hy-Rib between the mesh and engage the hooks over the flange of the joist. A half turn of the wrist throws one leg of the staple over the rib of the lath, and the full turn locks the second leg over the first and throws the loop back into the mesh. The hand, in the last operation is brought up almost against the Hy-Rib.

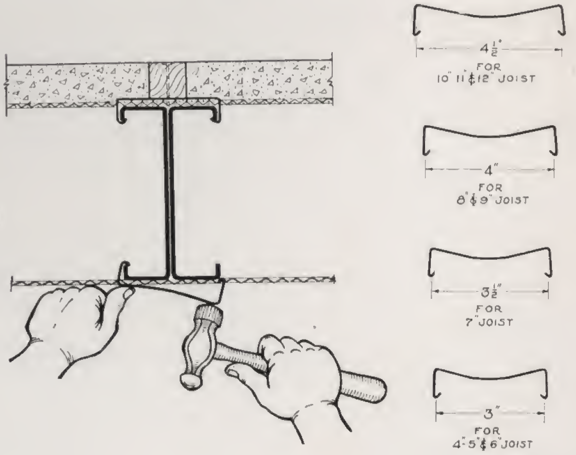
Screed Clips





The use of this clip provides a positive connection between the wood nailing screed and the steel joist. It allows the screeds to be levelled by means of wedges without loosening the connection, and eliminates the unsatisfactory use of nails driven into the joist.

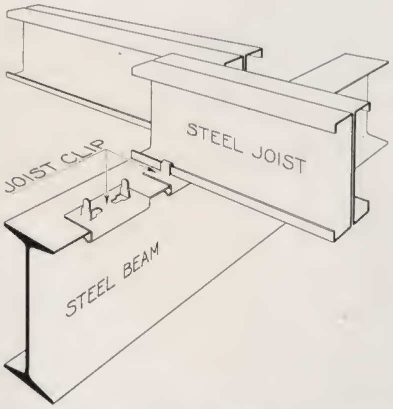
Spring Lath Clips



SPRING LATH CLIPS

Spring Lath Clips are also used to attach floor or ceiling lath to steel joists. These clips are made of high grade spring steel, are furnished in various sizes and are shaped to the flange, the convex center firmly pressing the lath against the joist.

Joist Clips



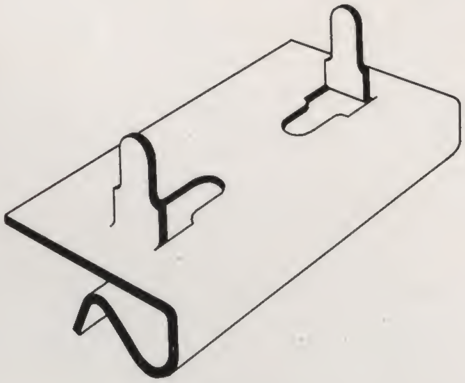
The Joist clip serves to securely anchor the joist to the beam, preserves correct spacing and otherwise prevents all movement of joists during installation.

In roof construction, in floors over basement, or wherever projection of beams is permissable, joists should rest on the top flange, thereby eliminating the expense of shelf angles and fabricating.

The same clip may be used to secure joists to top chord of roof trusses and to flange of riveted girders.

Joists should be so placed on top of structural members as to provide the necessary bearing. The minimum bearing recommended being 2½″ and on long spans we recommend a slightly greater bearing. This can be accomplished by staggering the joists if the top flange of the supporting structural member is not of sufficient width.

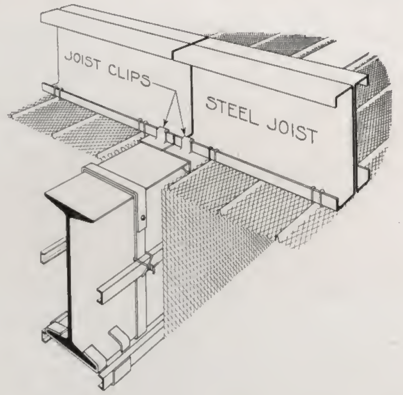
Sizes of Steel Joist Clips



Joist Clip

When ordering Joist Clips be sure to specify clearly the size required. Joist Clip "B" for 3″ and 3⅝″ joist flange. Joist clip "D" for 4″ and 4½″ joist flanges.

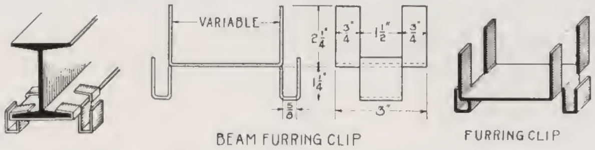
Beam Furring Clips



When the steel beams are fireproofed with metal lath and plaster the method shown above is suggested. Beam furring clips are fastened to the I beam by bending leg of clip over the beam flanges. ¾″ channels are supported on the seat of clip and held in a manner to prevent contact of fireproofing with beam.

Beam furring clips should be spaced not to exceed 30″ centers along the beams.

Beam Furring Clip for Various Sizes of Structural Steel Beams



Furring Clips are made from No. 15 Gauge (.072″) steel.

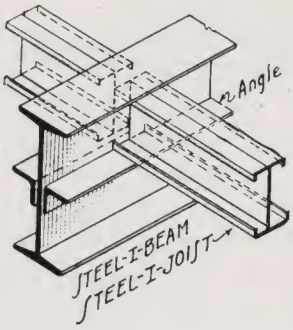
Designation Mark	Dimension A	Structural Steel Beams		Weight per 100 pcs.
		Standard	Bethlehem	
F—3	3″	4″—I@ 10.5 5″—I@ 10.0		50
F—3½	3½″	5″—I@ 14.75 6″—I@ 14.75		53
F—4	4″	7″—I@ 20.0 8″—I@ 18.4		57
F—4½	4½″	9″—I@ 21.8		60
F—5	5″	10″—I@ 25.4 12″—I@ 31.8		63
F—5½	5½″	12″—I@ 40 15″—I@ 42.9	8″—I@ 17.5 9″—I@ 20	67
F—6	6″	15″—I@ 60 18″—I@ 54.7	10″—I@ 23.5	70
F—6½	6½″	20″—I@ 65.4	12″—I@ 28.5 12″—I@ 36	73
F—7	7″	20″—I@ 80 24″—I@ 80	15″—I@ 38 15″—I@ 54	76
F—8	8″	24″—I@ 105	20″—I@ 59	83
F—9	9″	24″—I@ 74 27″—I@ 90	20″—I@ 72 24″—I@ 73	89
F—10	10 ″		28″—I@ 105	96

When ordering Beam Furring Clips give designation mark as "F—7."

Locating Shelf Angle for Steel Joist Bearing

The usual method of supporting steel joists on structural steel is by using a shelf angle riveted to the web of the girder. This reduces the beam projection below ceiling line. Where possible, steel joists should be supported on the top flange, thus saving the expense of shelf angles.

Shelf Angle Leg Down

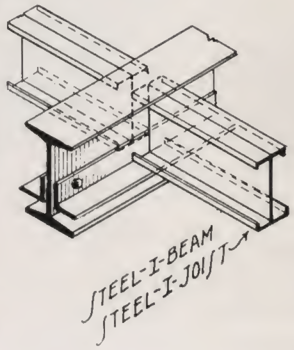


The position of shelf angle on steel beam should be so located that top of joist will come close to underside of beam flange.

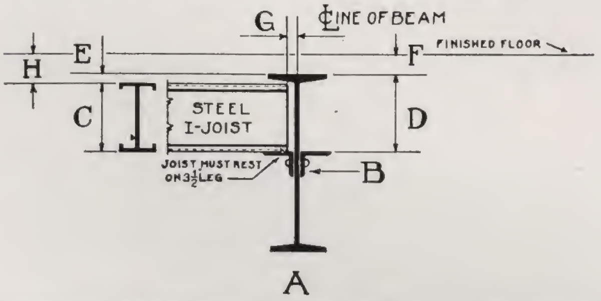
Table shows the maximum depth of steel joist that will frame into different structural beams when vertical leg of shelf angle extends downward as shown in sketch.

Shelf Angle Leg Up

When depth of joists approximates the depth of steel beam so that vertical leg of shelf angle cannot extend downward, the shelf angles are reversed as shown in sketch at right. In this case the length of joists should be slightly shorter than in detail at left to allow clearance for thickness of angle and protruding rivet heads.

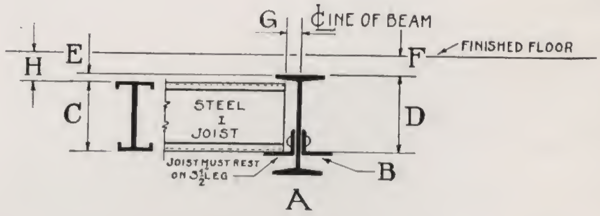


Framing Dimensions for Angle Leg Down.



Standard I Beams	Bethlehem I Beams	Size of Angles	Max. Depth Steel Joist	Distance From Angle to Top of Beam	Distance From Joist to Top of Beam	Distance From Beam to Fin. Floor	Clearance at End of Joist	Thickness of Standard Floor
A	A	B	C	D	E	F	G	H
8″ @ 18.4lbs.	8″ @ 17.5lbs.	3½x2½x¼	4″	4¾″	¾″	2⅛″	¾″	2⅞″
9″ @ 21.8lbs.	9″ @ 20.0lbs.	3½x2½x¼	5″	5¾″	¾″	2⅛″	¾″	2⅞″
10″ @ 25.4lbs.	10″ @ 23.5lbs.	3½x2½x¼	6″	6¾″	¾″	2⅛″	¾″	2⅞″
12″ @ 31.8lbs.	12″ @ 28.5lbs.	3½x2½x¼	7″	8″	1″	1⅞″	¾″	2⅞″
	15″ @ 38.0lbs.							
15″ @ 42.9lbs.	18″ @ 48.5lbs.	3½x2½x¼	10″	11″	1″	1⅞″	¾″	2⅞″
18″ @ 54.7lbs.	20″ @ 59.0lbs.	3½x2½x¼	12″	13⅛″	1⅛″	1¾″	¾″	2⅞″
20″ @ 65.4lbs.	24″ @ 73.0lbs.	3½x2½x¼	12″	13⅛″	1⅛″	1¾″	⅞″	2⅞″
24″ @ 79.9lbs.	26″ @ 90.0lbs.	3½x3 x¼	12″	13¼″	1¼″	1⅝″	1″	2⅞″

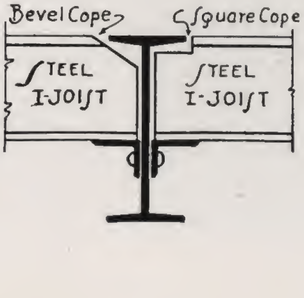
Framing Dimensions for Angle Leg Up.



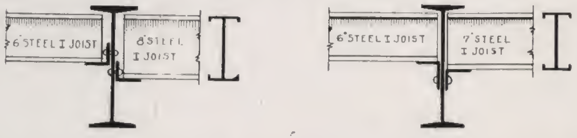
Standard I Beams	Bethlehem I Beams	Size of Angles	Max. Depth Steel Joist	Distance From Angle to Top of Beam	Distance From Joist to Top of Beam	Distance From Beam to Fin. Floor	Clearance at End of Joist	Thickness of Standard Floor
A	A	B	C	D	E	F	G	H
8″ @ 18.4lbs.	8″ @ 17.5lbs.	3½x2½x¼	6″	6¾″	¾″	2⅛″	1⅛″	2⅞″
9″ @ 21.8lbs.	9″ @ 20.0lbs.	3½x2½x¼	7″	7¾″	¾″	2⅛″	1⅛″	2⅞″
10″ @ 25.4lbs.	10″ @ 23.5lbs.	3½x2½x¼	8″	8¾″	¾″	2⅛″	1⅛″	2⅞″
12″ @ 31.8lbs.	12″ @ 28.5lbs.	3½x2½x¼	10″	10¾″	¾″	2⅛″	1⅛″	2⅞″
	15″ @ 38.0lbs.							
15″ @ 42.9lbs.	18″ @ 48.5lbs.	3½x2½x¼	12″	12⅞″	⅞″	2″	1⅛″	2⅞″
18″ @ 54.7lbs.	20″ @ 59.0lbs.	3½x2½x¼	12″	13″	1″	1⅞″	1⅛″	2⅞″
20″ @ 65.4lbs.	24″ @ 73.0lbs.	3½x2½x¼	12″	13⅛″	1⅛″	1¾″	1⅛″	2⅞″
24″ @ 79.9lbs.	26″ @ 90.0lbs.	3½x3 x¼	12″	13¼″	1¼″	1⅝″	1⅛″	2⅞″

Coping of Steel Joists

When tops of joists and beams are at same level joists are beveled or coped out as shown. An oblique cut simplifies fabrication, and costs less for double channel joists.

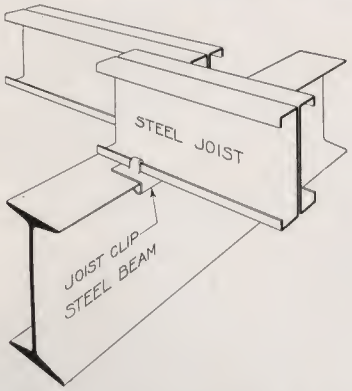


Framing of Two Sized Joists

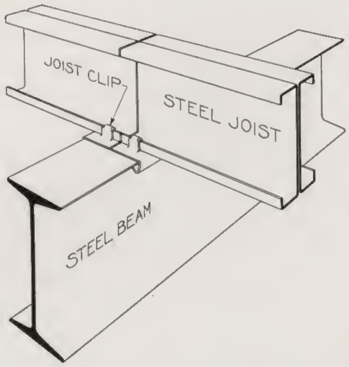


When steel joists of different sizes frame into the opposite side of a steel beam shelf angles with legs either down or up are used as indicated.

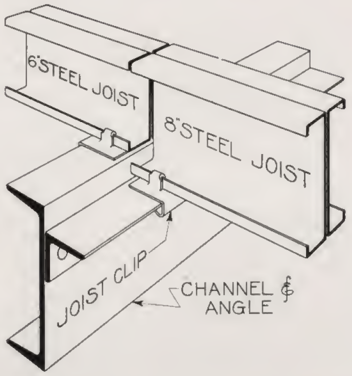
Details of Steel Joists Supported on Structural Steel



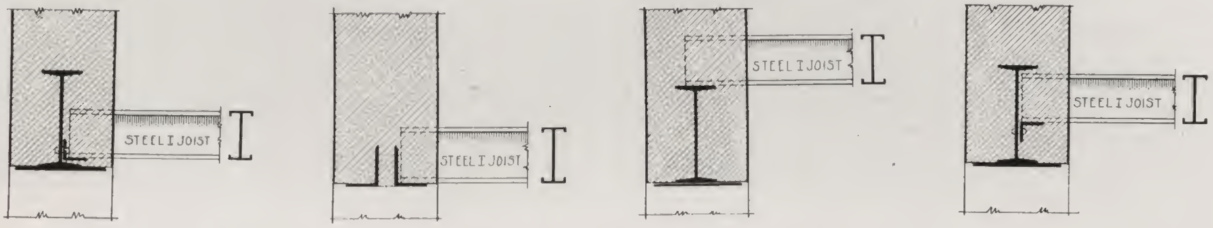
Showing steel joists set on top of supporting girder, with joists lapped. Joists secured to structural steel with standard joist clip.



Where the flange of supporting girder is sufficiently wide the joists can be butted and held in place by joist clips. Lapping of joists is usually recommended.

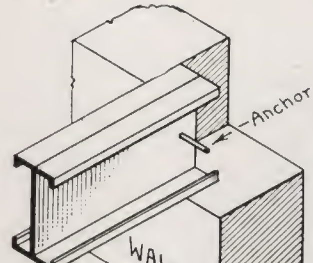


Where joists of different depths are supported on a channel section the floor level is maintained by using shelf angle to support the deeper joist.

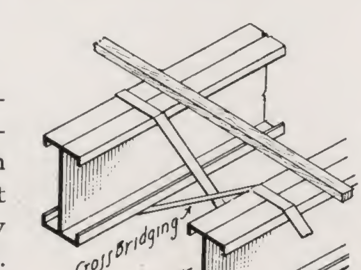


Details where steel joists are supported on Lintels in masonry walls.

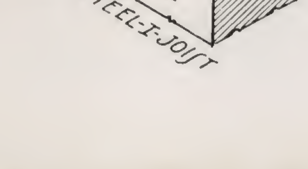
Details of Steel Joists Supported on Masonry Walls



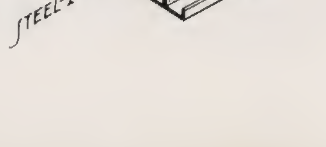
Joists supported on masonry walls should always have at least four inch bearing and not less than one-half the depth of the joist.



When the joists are set in a brick wall, cement mortar should be slushed in around the joist to insure a tight job.

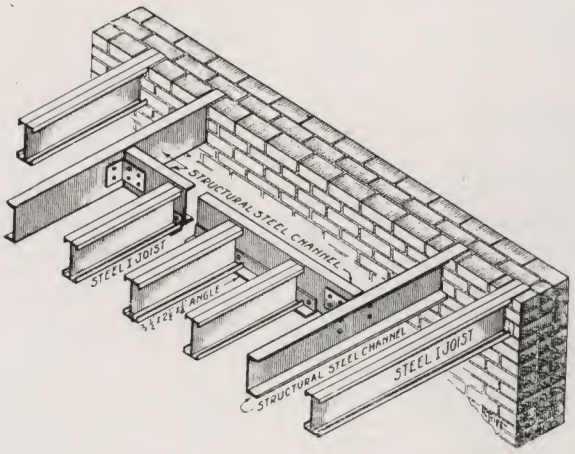


One method of anchoring the joist to masonry walls is to punch a hole in web and insert anchor bar. Bar may be bent back into wall.



A temporary wood strip should be secured to joists when first placed. This strip holds the joists in position until bridging is installed.

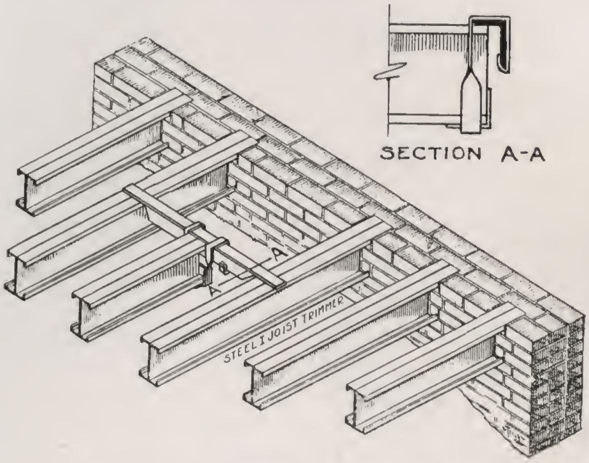
Details of Framing Around Openings



Around Large Openings

Framing around large openings such as stairwells requires structural steel headers and trimmers. In most cases the light weight structural channel the same depth as the joists will carry the loads. Standard connection details are used. The steel joist trailers are supported on shelf angles riveted to the back of the header channel.

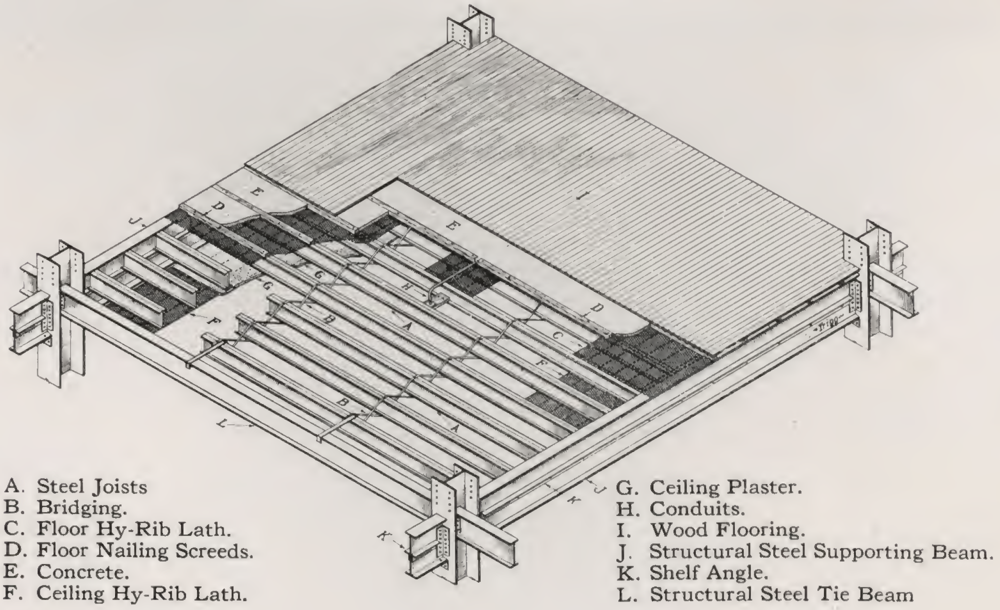
Often a structural angle itself will provide sufficient strength to serve as a header.



Around Small Openings

Framing around small openings such as ventilator ducts and chimneys is supported by the steel joists. A structural steel angle with strip hanger serves as a header to support the intermediate joist and itself rests on the adjacent joists as indicated in detail above. The wide spacing of joists will ordinarily permit the arrangement of ducts so that they can be kept entirely between the joists, thus avoiding all special framing.

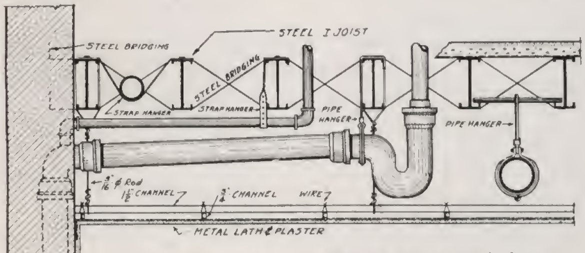
Standard Floor Construction Supported by Structural Skeleton Frame



A. Steel Joists
B. Bridging.
C. Floor Hy-Rib Lath.
D. Floor Nailing Screeds.
E. Concrete.
F. Ceiling Hy-Rib Lath.
G. Ceiling Plaster.
H. Conduits.
I. Wood Flooring.
J. Structural Steel Supporting Beam.
K. Shelf Angle.
L. Structural Steel Tie Beam

Truscon Steel Joists provide a simple, durable, light weight, firesafe construction. It is quickly and simply installed and is exceptionally economical in light occupancy buildings.

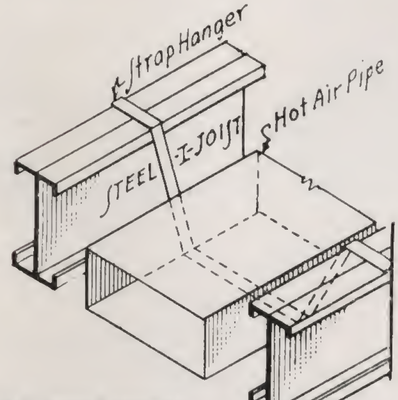
Details of Installation of Pipes and Conduits



Large pipes at right angles to joists.

Electric conduits and other small pipes are laid on top of the joists and buried in the concrete fill. Larger pipes are placed in space between joists when running parallel with the latter. When running at right angles to joists, pipes are hung with standard pipe hangers, steel straps or bridging as shown in the cross section opposite.

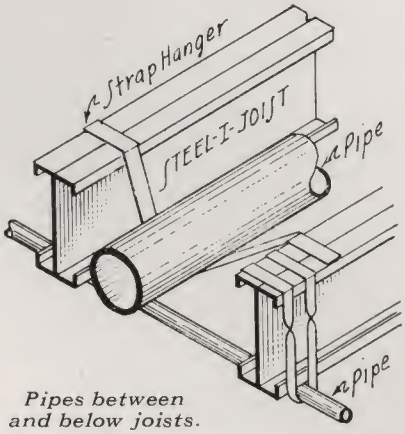
Where pipes extend below the joists the ceiling lath and plaster is suspended. The floor construction permits the economical covering of all piping.



Air duct between joists

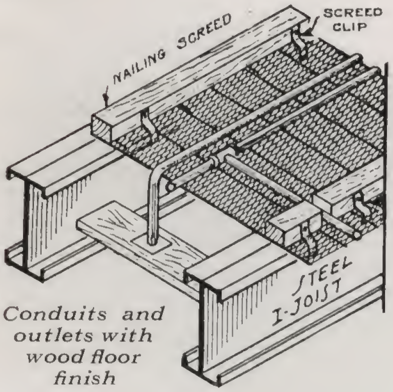
Ducts and Pipes

For supporting air ducts, pipes, etc., use coiled bridging as shown in the details. Pipes hung below the joists may be either supported by strap hangers attached to the top of the joists as shown or suspended from bars resting on the [lower flanges of the joists.



Pipes between and below joists.

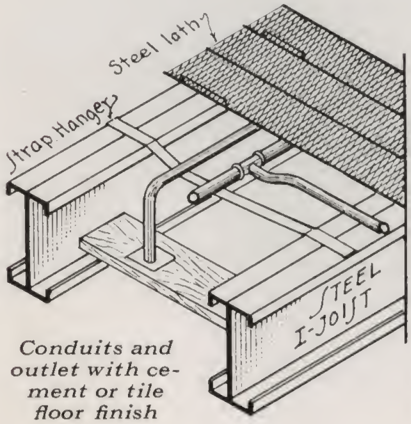
Conduits and Outlets



Conduits and outlets with wood floor finish

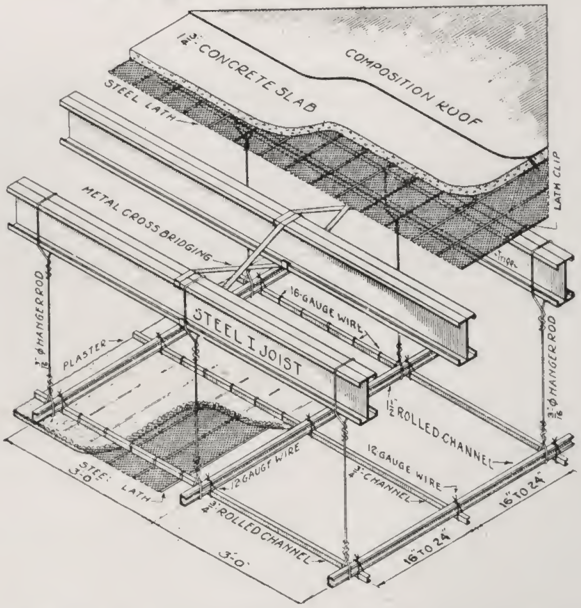
Various methods are employed to work out this detail. The shape of the joist section and the open space between the joists afford ample facility to carry out any of the methods commonly used.

When the floor finish is cement or tile it is best to lay piping before lath is placed. This gives a continuous reinforcing to the slab and prevents cracks over pipes.



Conduits and outlet with cement or tile floor finish

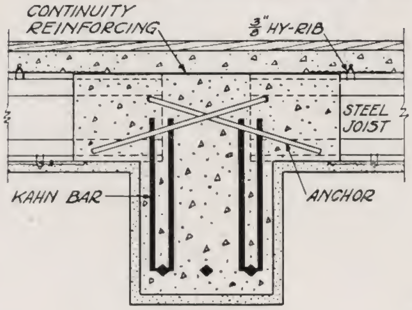
Suspended Ceilings



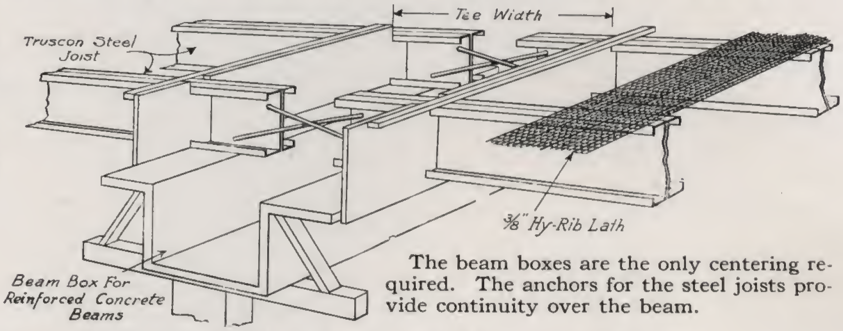
When the architectural features of a building make a suspended ceiling desirable, the ceiling lath is attached by tie wires to a framework constructed as shown above and on page 28.

Steel rolled channel sections, shown at bottom of page 11, are used for this framework. The sections are wired together in the field, making a rigid frame for the lath.

Steel Joists Supported by Reinforced Concrete Beams

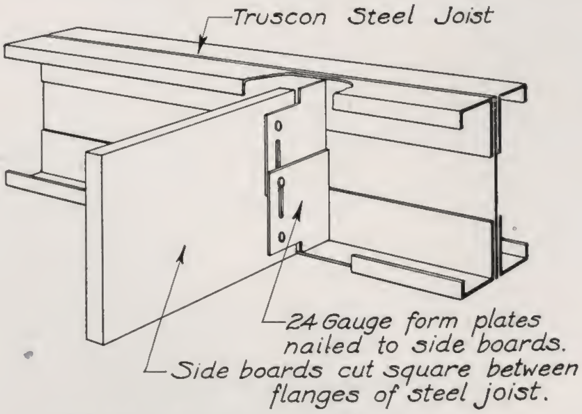


Cross section reinforced concrete beam.



The beam boxes are the only centering required. The anchors for the steel joists provide continuity over the beam.

Simple centering for reinforced concrete beam.


Truscon Steel Joist
24 Gauge form plates nailed to side boards.
Side boards cut square between flanges of steel joist.

Steel Form Plates for "T" Beams—24 gauge

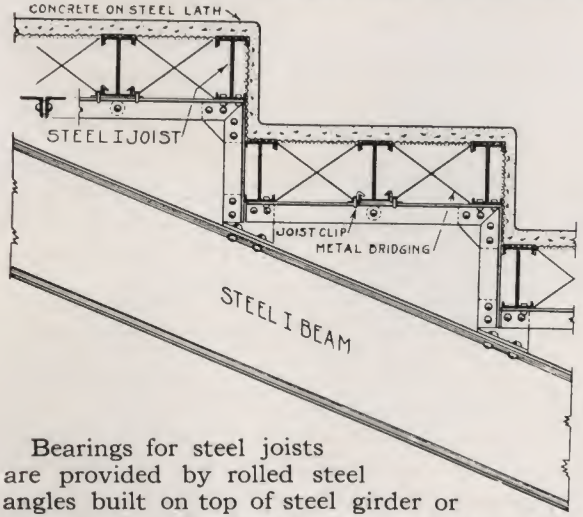
A framework of reinforced concrete beams and columns is frequently used to support Truscon Steel Joists. The reinforced concrete beam is made T-shaped. The Steel Joists extend well into the concrete beam and are anchored in place as shown in illustration. Note the continuity reinforcement over the beam.

The only centering required is to form the reinforced concrete T-beam. Side forms for the T between the Steel Joists may be cut to shape and made entirely of wood as shown above, or be cut square between the flanges and completed with 24-gauge form plates shown at left.

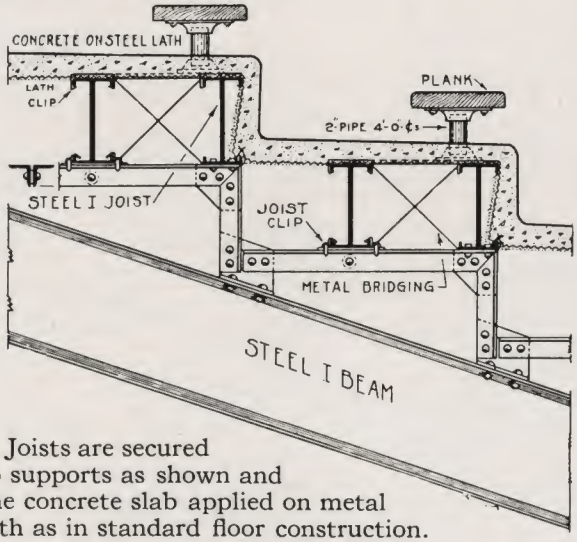
Truscon Steel Joists Framing Into Reinforced Concrete Girders.
Note Suspended Ceiling of Hy-Rib Metal Lath and Channels.

Jenss Bros. Department Store, Niagara Falls, N. Y.   Simon Larke, Architect   Braas Bros. Co., Contractors

Balcony or Grand Stand Details

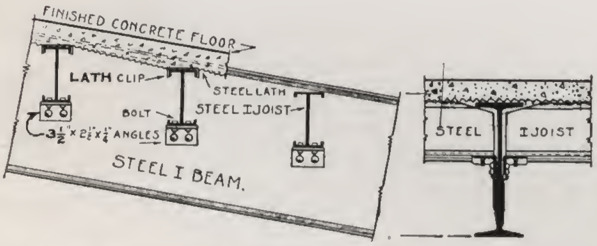


Bearings for steel joists are provided by rolled steel angles built on top of steel girder or beam to form the desired contour of steps.

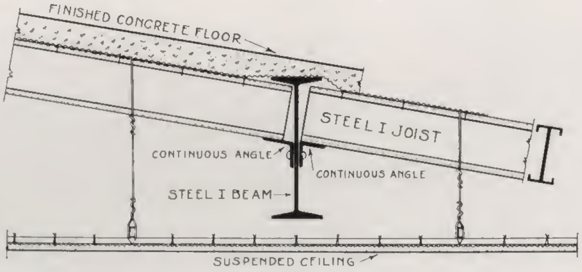


Joists are secured to supports as shown and the concrete slab applied on metal lath as in standard floor construction.

Sloping Roof or Balcony Details

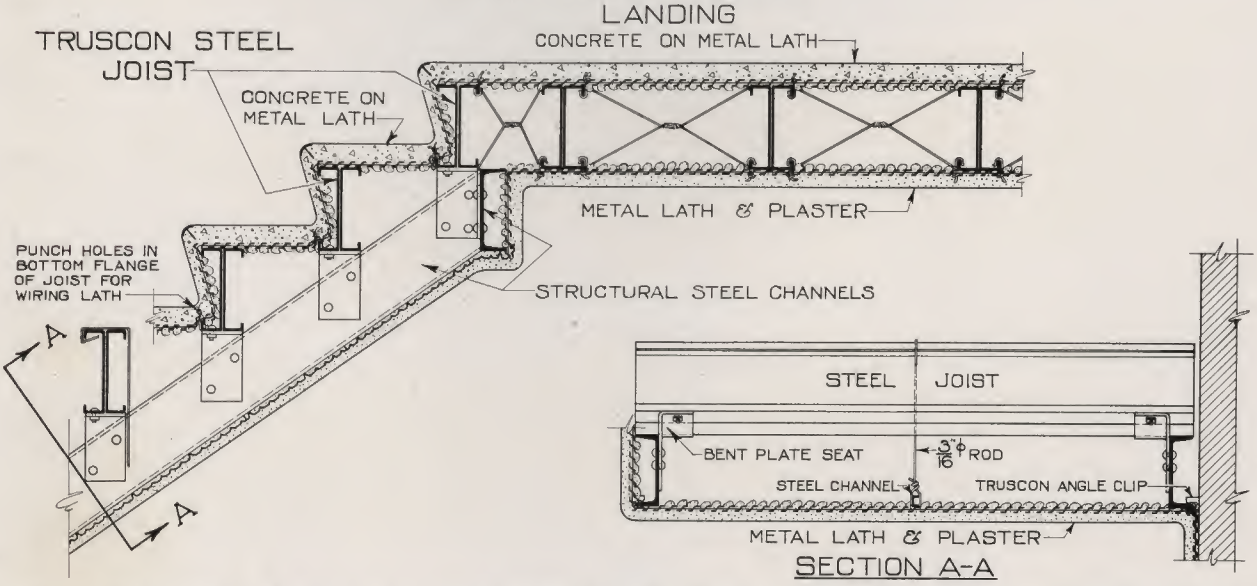


When supporting girders are on a slope.



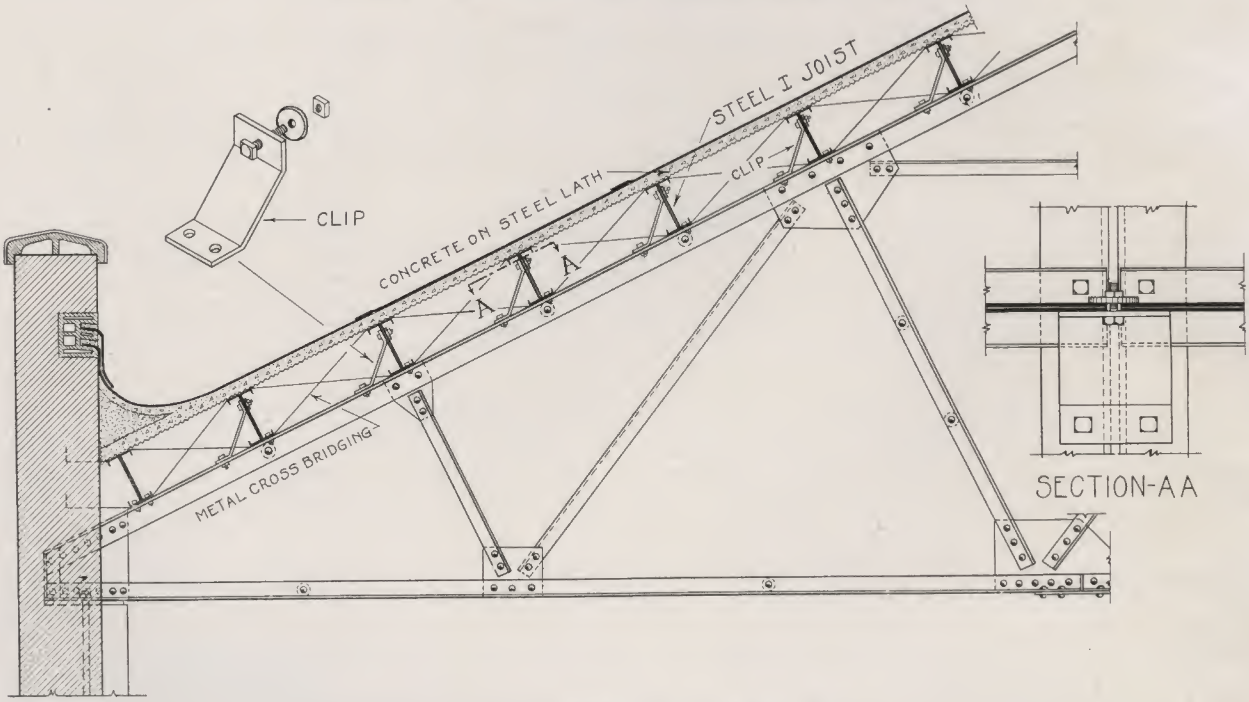
When steel joists are on a slope.

Stairway Details



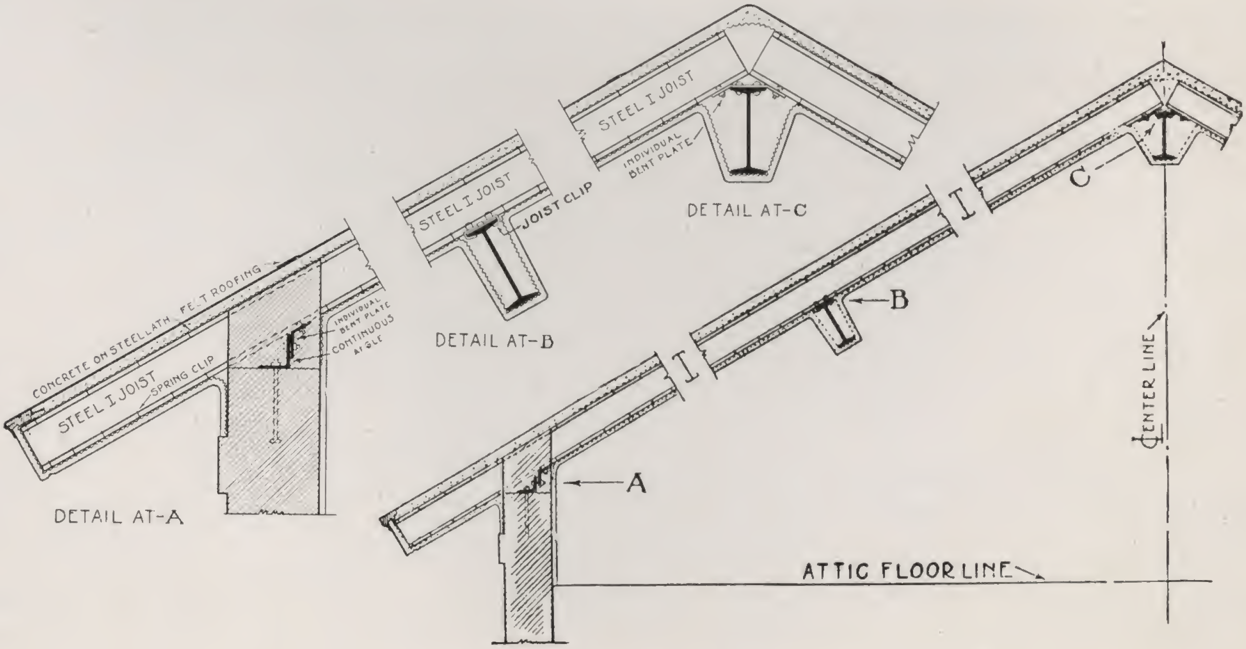
Supporting joists are placed as close as desired. This design is simple in construction, the angle brackets for the steel joists being riveted onto the stringers in the fabricating plant.

Roof Construction Details



Steel Joists Used as Purlins

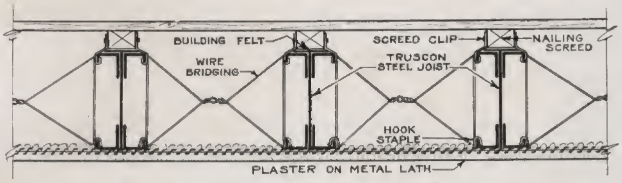
Steel Joists extend horizontally at right angles to the trusses. Ends of joists are secured to roof truss by bolting one flange of joist to chord angle. Webs of joist are braced by a specially formed clip as in Section AA. Steel lath and concrete fill are applied on top of joists as in standard floor construction.



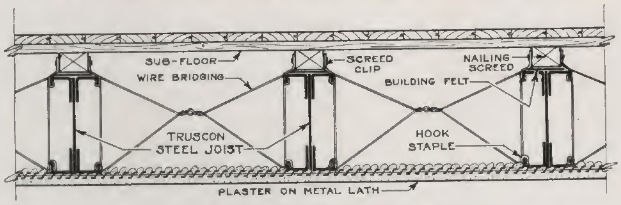
Steel Joists Used as Rafters

Steel Joists are on slope and are either bolted or connected to structural steel by beam or joist clips.

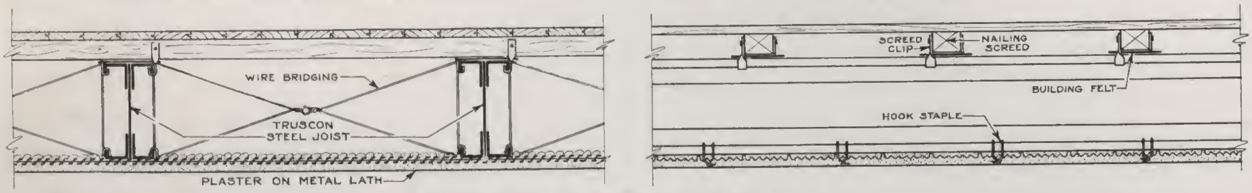
Wood Floors Secured Directly to Steel Joists



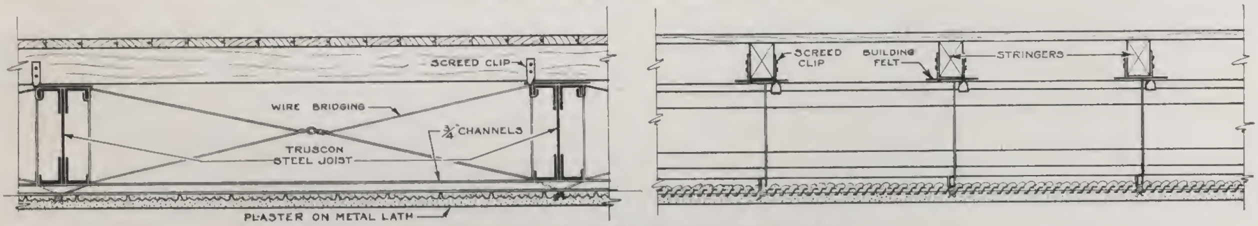
For Joist Spacings Up to 19 Inches



For Joist Spacings Up to 24 inches



For Joist Spacings From 24 to 30 Inches



For Joist Spacings From 30 to 48 Inches

The omission of floor lath and concrete over steel joists effects substantial savings over standard construction although reducing its fireproofness. For single and double thickness flooring with joist spacings limited to 19 and 24 inches respectively, nailing screeds are laid over center of joists. For greater joist spacings, nailing screeds of proper strength are laid at right angles to joists and spaced as required by thickness of flooring. In all cases nailing screeds are secured to steel joists by screed clips and building felt is laid between screeds and joists. For joist spacings not greater than 30 inches, metal lath for the ceilings is attached directly to joists with hook staples or lath clips. For greater spacings, ceilings consist of metal lath and channels.

Live Loads for Floors in Different Classes of Buildings

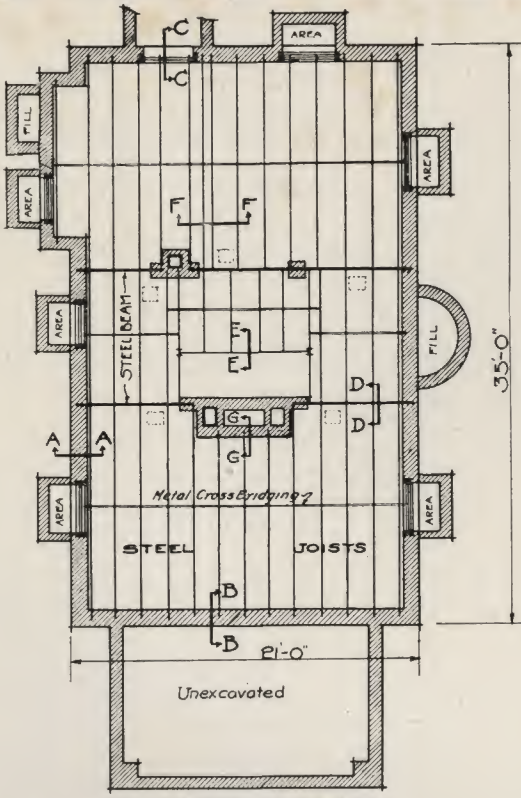
Extracted From Building Codes of Various Cities. Weight of Floor Construction Not Included.

No.	City	Dwelling Apartments Tenements or Lodging	Hotels	Office Buildings		Schools		Build'gs for Public Assembly	Stores	Light Mfg. and Light Storage	Garages (Public)	Roofs (Flat)	No.
				First Floor	Upper Floors	Class Rooms	Auditoriums and Corridors						
1	Atlanta	60	60	150	75	75	75	90	120	120	75	40	1
2	Baltimore	(b) 40	40	100	50	75	100	100	100	100	90	40	2
3	Boston	50	50	125	75	50	100	100	....	125	150	40	3
4	Buffalo	50	50	120	50	50	(d) 100	(e) 100	120	120	120	30	4
5	Chicago	40	50	50	50	75	100	100	100	100	100	40	5
6	Cleveland	70	70	125	70	70	70	100	(g) 100	125	(i) 100	35	6
7	Dallas	40	50	150	50	60	90	(f) 100	120	120	80	25	7
8	Detroit	40	40	125	50	50	80	(f) 100	(g) 100	125	100	30	8
9	Kansas City	60	60	150	75	60	90	90	120	120	80	50	9
10	Milwaukee	30	30	80	40	40	60	(k) 50	100	100	80	30	10
11	Minneapolis	50	50	100	75	75	(n) 100	125	100	100	100	50	11
12	New York	40	40	60	60	75	75	100	120	120	120	40	12
13	New Orleans	(a) 40	40	125	70	60	125	(l) 125	125	125	....	30	13
14	Omaha	50	50	50	50	50	75	100	100	100	100	30	14
15	Philadelphia	40	40	120	60	75	100	100	(j) 100	120	120	30	15
16	Pittsburgh	(b) 40	50	....	....	....	....	....	....	....	125	40	16
17	Portland, Ore.	(b) 50	50	125	60	60	75	80	(g) 100	125	(g) 80	40	17
18	Providence	(c) 50	50	150	75	60	125	(m) 125	125	125	150	40	18
19	San Francisco	40	40	125	40	75	125	(f) 125	100	125	100	30	19
20	St. Louis	50	50	100	60	75	100	100	150	100	100	30	20
21	St. Paul	40	50	50	50	60	125	100	125	100	100	30	21
22	Seattle	40	40	125	50	50	100	100	100	125	....	40	22
23	General Average of other Cities	40	40	100	50	60	80	(e) 90	100	125	80	40	23

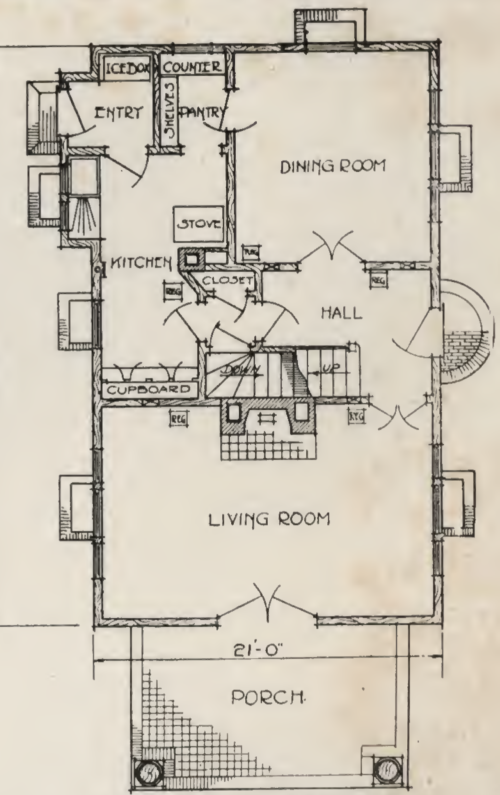
Office and Public Rooms (a) 70, (b) 80, (c) 100.
Corridors (d) 80.
Fixed Seats (e) 80, (f) 75.

First Floor (g) 125, (h) 100, (i) 150, (j) 120.
Drill or Dance Halls (k) 100, (l) 150, (m) 200.
Assembly Rooms (n) 125.

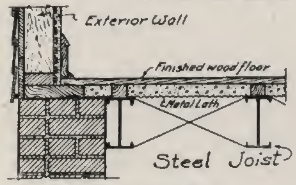
Truscon Steel Joists for Fire-Safe First Floors of Homes



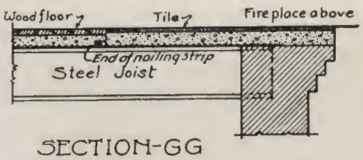
BASEMENT PLAN



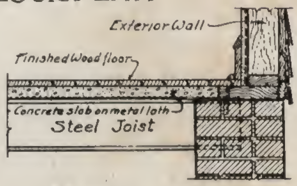
FIRST FLOOR PLAN



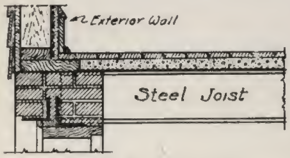
SECTION-AA



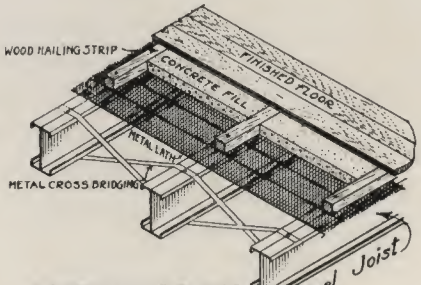
SECTION-GG



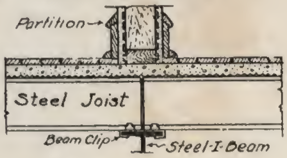
SECTION-BB



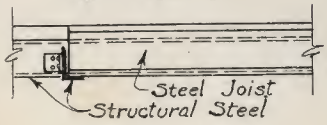
SECTION-C C



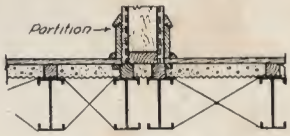
ISOMETRIC DRAWING
Showing Steel Joist floor construction



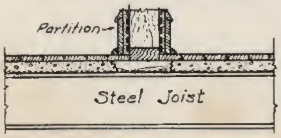
SECTION-DD



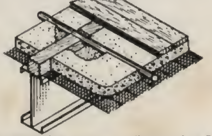
SECTION E-E
Showing steel framing around stair opening.



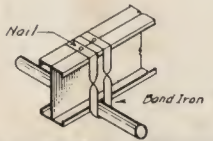
SECTION-F F



DETAIL
Showing partition running at right angle to Steel Joist



ISOMETRIC DRAWING
Showing nailing strip notched out so that water pipes or wire conduits can be placed under wood floor into concrete slab.



ISOMETRIC DRAWING
Showing method used to suspend pipes from Steel Joist

Form D-456, 5M, 3-24-A. P.

TRUSCON
STEEL JOIST
DATA BOOK

TRUSCON STEEL COMPANY
YOUNGSTOWN, OHIO, U.S.A.